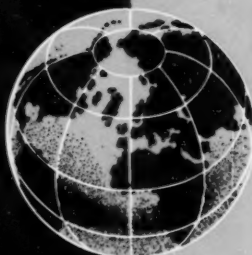


MINING WORLD



MAY 1961

HIGHLIGHTS

in mining this month

New California asbestos mine and mill planned near Copperopolis by Jefferson Lake Sulphur Company. Chrysotile ore will be mined and milled at 2,500 ton per day rate to yield Groups 4, 5, and 7 fibers 17

Atlantic City taconite mill of United States Steel Corporation will be first in west. Ore is almost identical with Mesabi Range taconite. Three stage crushing, rod and ball mill grinding with three-stage magnetic separation will be the flowsheet 18

Lucky Friday's new sand fill system is automated for one-man operation and controlled from underground stope. Special controls and signals make it possible for one man to start and stop sand flow, flush and clean tailing lines, and operate the mill tailing pump .. 22

Craigmont completes copper mine stripping in southern British Columbia and moves in mining equipment. Mill construction is well advanced with completion target and 4,000 ton per day milling rate scheduled for early autumn 24

How computers can save you money from exploration to milling was the theme of the computer course at the University of Arizona's College of Mines. With more than 100 engineers registered from 50 mining companies in many parts of the United States and abroad the mining industry begins to learn of the versatility and many potential uses of these high-speed machines 28

Meramec Mining Company's Pea Ridge, Missouri iron ore mine development is right on schedule for first pellet shipments in 1963. Development and diamond drilling at No. 1 Shaft seeks data on which to plan mining method 30

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IF PURCHASES ARE ENDORSEMENTS...

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In recent years 68% of all American made 4.5 to 9 yard electric mining shovels bought for use throughout the world have been P&H

P&H has earned such widespread acceptance in the mining industries because of lower per-ton loading cost. This profit premium to owners of P&H Electrics results from these two basic advantages:

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abrasive rock
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(Siliceous limestone,
dolomite, sandstone,
granite)



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(Limestone, sandstone,
sandy shales)



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New features include angle drilling to 25 degrees, a maintenance-free ejector type dust collector, enclosed operator's cab and full working platforms. Also, choice of famous DHD-500 and DHD-400 Downhole drills for hole sizes from 7½ to 9 inches. Air power is supplied by two Gyro-Flo 900 rotary compressors available in diesel or electric drive.

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A CONSTANT STANDARD OF QUALITY IN EVERYTHING YOU NEED FOR DRILLING ROCK



New California asbestos mine and mill are planned near Copperopolis by Jefferson Lake Sulphur Company. The chrysotile ore will be mined in open pit and treated in 2,500 ton per day mill to yield Groups 4, 5, and 7 fibers 17

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MILLER FREEMAN PUBLICATIONS



MINING WORLD, May, 1961. Volume 23, No. 6. Published monthly except April, when publication is semi-monthly at Lancaster, Pa. Executive, advertising and editorial offices, 500 Howard Street, San Francisco 5, California. Subscription in United States, North Central and South America, \$4.00 per year; other countries, \$5.00 per year. Entered as second class matter Oct. 10, 1951 at the Post Office at Lancaster, Pa., under act of March 3, 1879. Postmaster, please send notice 3579 to MINING WORLD, 500 Howard Street, San Francisco 5, Calif.

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REPORT FROM WESTERN MATERIALS INC., PAMPA, TEXAS



"Our new 944 Traxcavator loads and levels nine 18-yd. trucks an hour

It gets its bucket full easier than other machines, is faster and handles better. Has plenty of reach for big trucks, too."

THAT's the word on the 944 from Craig Childers, Western's Plant Superintendent. And here's what the operator thinks about it, "I like the way it handles. It's really a fast-loading machine; and it has good balance and visibility. The idea of having the lift arms out front where you don't sit between them is great."

You can choose from three sizes in the new Traxcavator line. The 944 packs 105 HP and a 2 cu. yd. standard bucket—the big 966 at 140 HP carries a 2¾ cu. yd. standard bucket—and the 80 HP 922 has a 1¼ yd. bucket. All three mount a variety of buckets and attachments for handling various materials. And all three have what it takes to move more tons per hour and stay on the job month after month with far less maintenance.

Your Caterpillar Dealer has all the facts. Ask him to set up a Traxcavator demonstration on your job, and get a firsthand look at all the new ideas that are built into these machines. It'll be a real eye-opener.

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**TRAXCAVATORS
ARE MAKING OTHER
LOADERS OBSOLETE**

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CAT DIESEL ENGINES—Turbocharged for efficiency and quick acceleration. Optional gasoline engines for the 922 and 944.

CAT POWER SHIFT TRANSMISSION—gives instant shifting, forward and reverse, 1st and 2nd speeds. High and low range selector also provides two-wheel drive for roading, four-wheel drive for power and traction in work cycles.

OPERATOR SAFETY—Lift arms and cylinders are forward of the operator and cockpit. Visibility is excellent and access is easy... up three wide steps.

LONG REACH—With the lift arms up front, the reach at dumping height of the new Traxcavators is impressive: 57" on the 966, 51" on the 944 and 41" on the 922.

OPERATOR CONVENIENCES—Bucket controls have automatic positioners to speed every cycle; machine controls are all power boosted for easy operation. Dual brakes give operator choice of braking with or without transmission engaged.

FULL LINE OF ATTACHMENTS—Special material buckets, side dump buckets, forks, cabs, etc.

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Published by Miller Freeman Publications
Wm. B. Freeman, President
Miller Freeman, Jr., Exec. Vice-President & Treas.

SUBSCRIPTION RATES:
U.S., North, South and Central America \$4.00
Other Countries \$5.00
Single Copies \$.50
Directory Number \$1.00

CHANGE OF ADDRESS:
Send subscription orders and changes of address to MINING WORLD, 500 Howard Street, San Francisco 5, California. Include both old and new addresses and zone numbers.

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OME Loans For Au and Ag

The first important news to the mining industry from the New Frontier has been good news. Good news for gold and silver developers and producers. Interior Secretary Stewart Udall on March 29th proposed that these two strategic and precious metals be added to the list eligible for exploration financing by the Office of Minerals Exploration. OME is the successor to the Defense Minerals Exploration Administration which participated so vigorously and effectively with the mining industry in the late 1950's in exploration for a wide variety of minerals. Thus, OME has the staff and the know-how to efficiently and quickly extend assistance to gold and silver miners.

The Secretary's proposal was designed to strengthen the domestic mining industry and give aid to depressed areas, so he also added iron ore to the eligible list and announced that OME will pay up to 75 percent of the authorized cost for beryllium, chromite, mica, and asbestos.

MINING WORLD takes just pride in the Secretary's announcement about gold and silver because their inclusion for OME aid was specifically recommended by the Editor on March 7th, in a speech before the Prospectors and Developers Association in Toronto, Canada. Also recommended was 100 percent depletion for both metals. Highlights of this speech with nine major reasons "Why Canada and the United States Must Mine More Gold and Silver" were included on page 26 of the April 1961 issue.

This is certainly an important step forward for gold and silver. Let us all hope that it is only the first. Write the Secretary, write your Senators, write all your state's Congressmen of the need for expanded exploration for and development of all the nation's minerals.

More Mines in the Making?

The Arizona news section of this issue contains a review of exploration and mining activity in the Patagonia district. It's good news to read about the many exploration projects under way there.

The important news though is to see the names of the engineer and prospector who are financing two major projects—Charles A. Steen, and W. D. Roper. Each made his stake in mining. Charlie by discovering Utah's Big Indian uranium district and rewriting the geology of uranium deposits. Mr. Roper and his family for selling a group of claims at Safford, Arizona, with large low grade copper reserves to Phelps Dodge Corporation early this year.

They both are hot on the trail of another mine, and they're drilling and cross cutting to find it. That's the true spirit of prospecting—keep looking and keep digging. The big companies with plenty of money had better watch these prospectors. We all hope they will soon have more to develop and sell.

Good luck to two real prospectors.

CAPITOL concentrates

GOVERNMENT ACTION AND REACTION AFFECTING MINING



Gold and Silver on OME List; Get Loan Forms from Washington . . .

Exploration assistance has been extended to gold and silver by the Office of Minerals Exploration under a proposal of Interior Secretary Stewart L. Udall. Other minerals proposed for assistance were iron, bismuth, sulphur, and tellurium. These additions became effective on April 28.

Under the new regulations the government will contribute 75 percent of

the total allowable costs of exploration for the following: asbestos, bauxite, beryllium, chromite, columbium, corundum diamond (industrial), graphite (crucible flake), kyanite (strategic), manganese, mercury, mica (strategic), nickel, platinum group metals, quartz crystal (piezoelectric), talc (block steatite), tantalum, and tin. The 50 percent allow-

able assistance is for antimony, bismuth, cadmium, cobalt, copper, fluorspar, gold, iron ore, lead, molybdenum, monazite, rare earths, rutile, selenium, silver, sulphur, tellurium, thorium, uranium, and zinc.

Application forms and additional information may be obtained from the Office of Minerals Exploration, Department of the Interior, Washington, D. C.

Change in Beryl Purchase Program Proposed to Include Concentrates . . .

Representative Wayne Aspinall of Colorado has introduced H. R. 5769, a bill designed to loosen up the government's beryl purchase program—one of the last of the DPA domestic mineral purchase programs left alive.

The program called for the purchase of 4,500 short tons of "hand-cobbed" beryl by June 30, 1962. There is a general suspicion that the specifications are so tight that the program will by no means be saturated when the expiration date arrives. As beryl has to be crushed and ground before use, there has been no apparent reason why beryl concen-

trates should not be included in the program, unless OCDM has hoped that the program would expire before the quota is filled, thus making it unnecessary to spend a large sum of bonus money.

The Aspinall bill would insist on a survey of the program by GSA to determine whether the 4,500 tons would be purchased by June 30, 1962, or how much of the quota would remain at that time and, if considerable, would require that GSA "promptly amend" the regulation "to include the purchase of any form of beryllium ore which has a beryllium oxide con-

tent and other characteristics satisfactory for defense purposes. . . ."

This change should have been made a long time ago. The move will cost no more money than was set aside for the original program; although it may be argued that money would be saved if all the 4,500 tons of "hand-cobbed" beryl are not purchased. Aspinall's plan would give a break to those companies which are producing concentrates.

This change should be made on order to GSA by OCDM rather than by legislation which may take some time to enact.

BLM Organizational Changes Ordered to Strengthen Staffs . . .

Organizational changes in the Bureau of Land Management's offices have been ordered by Secretary of Interior Udall to "strengthen the technical and operating staffs" at state headquarters. Technical functional offices are to be consolidated now performed at three re-

gions with similar services in state bureau offices, Udall said.

The three regional offices are located at Portland, Denver, and Salt Lake City. Merging of the technical staffs of the regional and state offices will involve increases in personnel assigned to Sacramento, Los Angeles, Boise, Reno, Billings, Cheyenne,

Santa Fe, and Phoenix. E. I. Rowland, bureau supervisor for Arizona, said that 15 to 20 employees will be added to the Phoenix office, principally by transfer. Engineering personnel to be added will include surveyors and draftsmen. Specialists in land, minerals and management also will be added.

Udall Claims Broad Mandate to Develop Natural Resource Program . . .

Among the speakers at the North American Wildlife and Natural Resources Conference was Interior Secretary Stewart Udall. He accused the previous Administration of allowing the Interior Department to "slowly settle into a rut of lackluster performance," and reported that he had been given a broad mandate to develop a natural resources program which will include provisions for states to ac-

quire land for wildlife preserves and local recreation areas.

Apparently, not only is the federal government committed to the wildlife proposal now before the Congress, and which is being pressed hard by the powerful and vocal conservation groups, but there is a movement for the states to follow suit. No doubt a need does exist for more state parks, particularly within reasonable dis-

tances of urban areas, but to encourage the states to put large areas in a "deep freeze" as is contemplated by the wilderness bill is another matter.

Udall's remark that "the overriding mandate to the conservationists today is to preserve the natural habitat of man" seems oddly phrased. The wildlife groups appear to want to keep the animals in and man out of the wilderness areas.

JOE IS PROUD OF HIS NEW BABY!

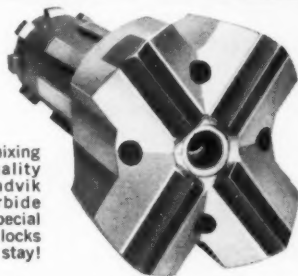
Good reason, too! He's got a 9-inch down-the-hole bit from Sandvik-Coromant, and that means he's got a bit that's better than he's ever used before!

Strong statement? Sure. But here's proof:

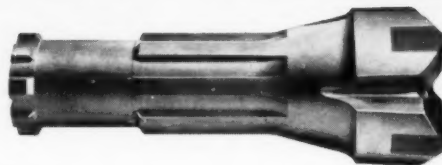
First, Sandvik is one of the world's largest and most experienced manufacturers of tungsten carbide. Therefore, Joe gets the highest quality carbide possible. From more effective refining, through better mixing, to more careful control of grain size—everything possible is done to assure Joe longer bit life and more feet between sharpenings.

More proof: Sandvik carbide inserts *stay in*, thanks to our unique brazing method. And since the entire bit is made from Swedish steel—Joe knows breakage won't be a problem.

You'll be happy with Sandvik-Coromant down-the-hole bits, too. They're available from 4½ to 9 inches in diameter, and for all types of rigs. Get in touch with your nearest Atlas Copco office today, or write to Dept. MN 61-2.



Better refining, mixing and over-all quality control by Sandvik means best carbide possible. And a special brazing method locks the inserts in to stay!



Sandvik down-the-hole bit bodies are made from Swedish steel by Swedish craftsmen. Result: less breakage...longer life!

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Eleven-second dumping with positive power-up, power-down control of body action is provided by the inverted, double-acting hoist system as furnished by International. For similar all-around cycle-speeding advantages in a 19-tonner, see the 65 Payhauler!



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Here are five of the nine 95 Payhauler rear-dumps owned by Florida Rock Products Corporation—hauling from quarry to crusher. Fleet operates in Hernando County, Florida.

**"Our Payhauler units are doing everything we expected of them—
and are performing very satisfactorily."**—T. S. BAKER, President
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Florida Rock Products Corporation moves rock from quarry to crusher with a fleet of nine International Model 95 Payhauler rear-dumps. Payhauler offers an exclusive combination of capacity-adding, cost-reducing features of special appeal for tough, heavy, off-road mine and quarry hauling.

Of all 27-ton off-road haulers, only the 95 Payhauler gives you the ton-shedding, brawn-boosting advantages of the rock-ribbed corrugated body. Only the "95" is plus-powered by the 375-hp DT-817 turbocharged International diesel engine. Choose the "95" with power-shift torque converter or 9-speed air-shift transmission.

Grade charts prove that the "95" Payhauler is in a class by itself for upgrade hauling—giving a speed advantage of up to 44%! Compared to 27-ton competitors, only the "95" is "one hand" power-steered with International's high-leverage enclosed system

—or is quick-dumped (in 11 seconds) with power-up, power-down inverted hoist action.

See for yourself in your own off-road hauling how an International Payhauler can increase your capacity, and give you record economy. Let your International Construction Equipment Distributor demonstrate.



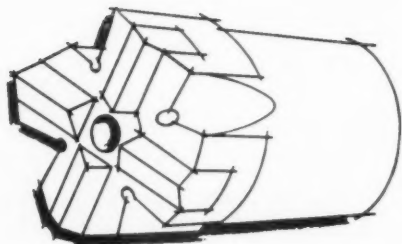
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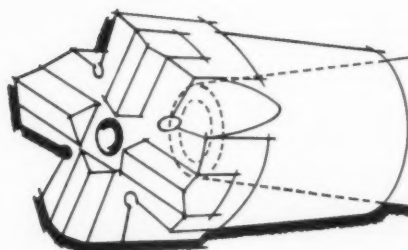
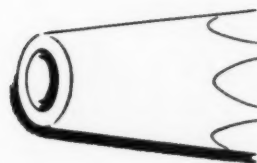


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POWER above ground or at the face—for shuttle cars, hoists or shovels... lighting
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**This
removable
bit
gives**



one-piece strength

--- cuts air-leg drilling costs

ONE big reason Timken® tapered socket bits save you money is—you don't have to throw away good drill steels after the carbides wear out as you do with intra-sets. Timken bits are removable—yet have one-piece strength. You can keep on using good steels.

And those Timken bits save you even more because only a pocketful are needed for a day's work. Compare that to lugging an armful of intra-sets to the mine face.

Still another reason: with Timken bits you can change bit gauge sizes fast on the same steel. No changing the whole steel.

What's more, *only* the bit itself need go in for resharping. You don't have to haul the whole steel. And Timken bits give longer gauge wear because there are four cutting edges. Most intra-sets have only two.

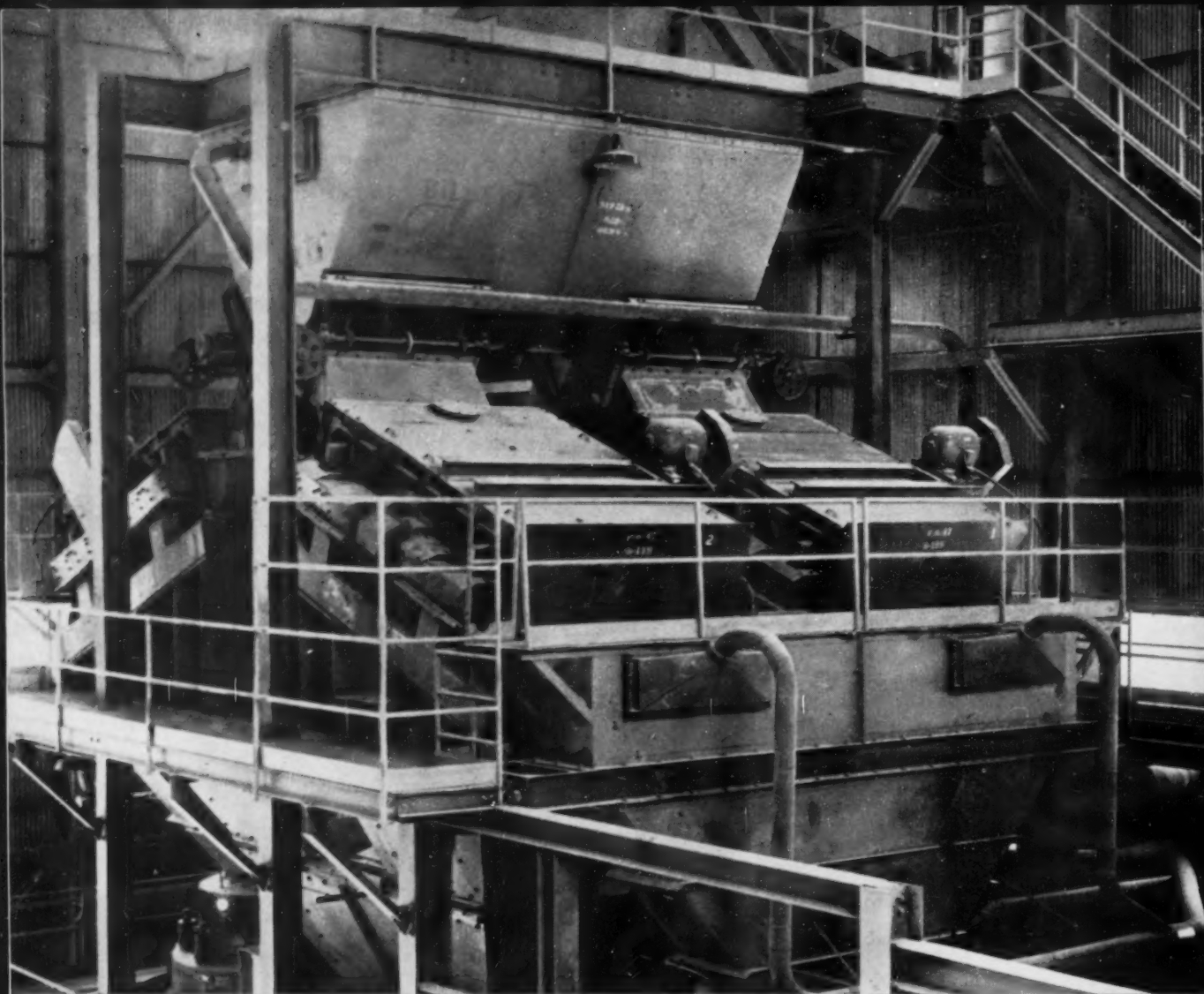
Add them all up and see why you'll cut your drilling costs with the TTC—air-leg bit that's tapered for one-piece strength—made of tough, Timken fine alloy steel for longer life. The bit that clears chips faster as the diagram at right shows. Send for free brochure, "Timken Removable Rock Bits". The Timken Roller Bearing Company, Rock Bit Division, Canton 6, Ohio. Cable address: "TIMROSCO". Makers of Tapered Roller Bearings, Fine Alloy Steel and Removable Rock Bits.



FASTER CHIP CLEARANCE because five front holes shoot air or water directly against the rock face. And deeper, wider wing clearance lets chips wash back faster.

TIMKEN®

removable rock bits



In 7 years of operation Tyler Ty-Rocks screen 15,000,000 tons of ore at Silver Bell Mine... "maintenance virtually nil"

These four single-surface Ty-Rock screens at the Silver Bell Mine of American Smelting and Refining Company have screened mountains of copper ore. Yet in seven years of operation the company reports "no bearing or other major replacements, and maintenance virtually nil"... a tribute to the fine operating staff and to the design of the equipment.

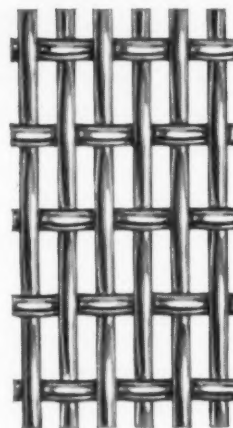
Tyler vibrating screens handle tremendous outputs with very high reliability. And no matter what your screening requirements, Tyler can handle them: heavy duty mechanical screens, electric screens, economical two-bearing screens. And—Tyler is the world's largest manufacturer of wire cloth and fabricated screen sections.

For screening equipment perfectly matched to your needs check with Tyler.

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Land Cruiser has the room to take 7 passengers or a big payload of equipment because its hardtop or soft top bodies are 12½ ft. long, 5½ ft. wide.

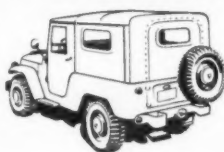
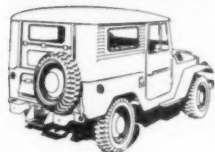
Land Cruiser has the economy to slash your transportation costs. Initially, a Land Cruiser costs no more than any comparably equipped competitive 4-wheel

drive vehicle of half the horsepower! From there on, you save on every trip because the Toyota Land Cruiser gets up to 28 MPG of gas from its highly efficient Toyota engine. You spend less time and money on maintenance because the Land Cruiser is more rugged, more durable, more vehicle than any of the others. And when it comes to regular servicing, you save again because every part of the Land Cruiser which needs periodic inspection is more accessible.

Drive a Toyota

LAND CRUISER

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Send me more facts on the Land Cruiser and name of my nearest dealer.

Name _____

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Among the features of Western cars that assure low maintenance cost and profitable operation are these:

- Door control mechanism, located at ends of car—sturdy, fully enclosed, foolproof
- Exclusive dual side pivots, permitting dumping with least effort and air consumption
- Fast-acting dumping mechanism and steep dumping angle to speed up operation
- Automatic cutoff valve for smooth dumping
- Body underframe of one all-welded unit, heavily reinforced throughout
- Double-plate, curved-top door, strongest made—able to ride over obstructions when pulling out of a dumped load without damaging the dump mechanism or the door operating mechanism
- Low center of gravity to assure stability in all situations

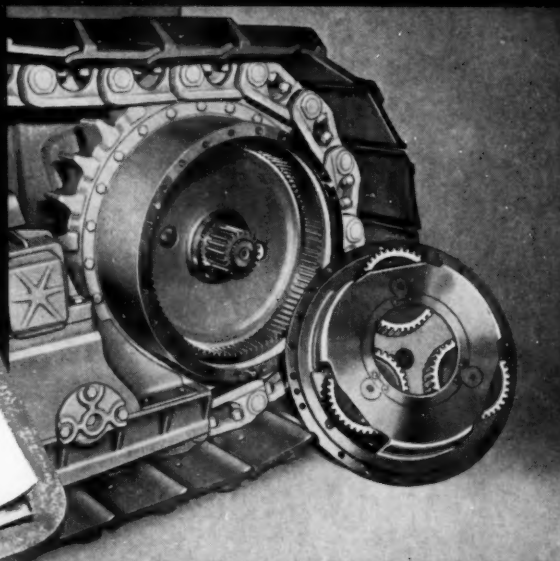
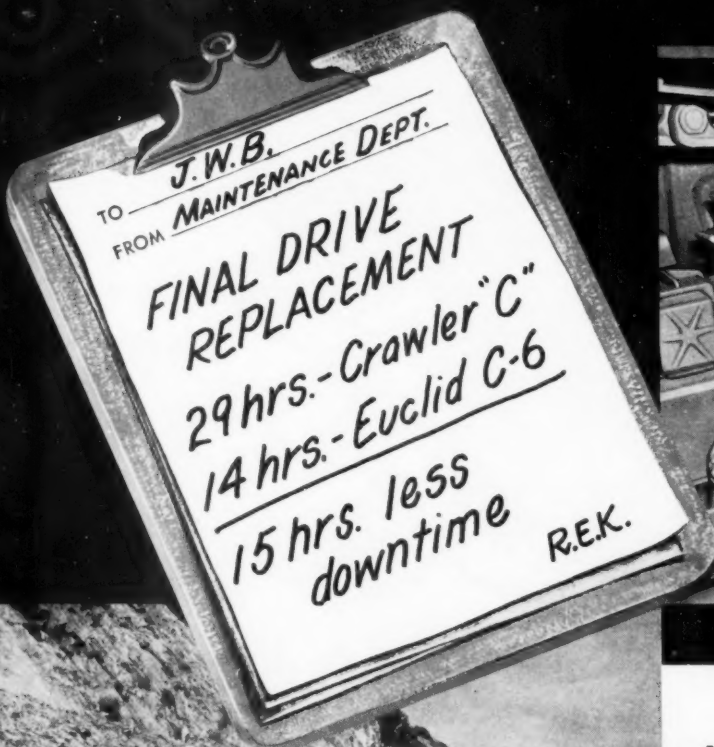
Western dump cars, built by B-L-H, are available in any size up to 60 cu. yd., any capacity up to 100 tons. Let us show you facts and figures on how the advantages of Westerns pay off.



BALDWIN · LIMA · HAMILTON

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...a saving of 15 hours labor and productive time with the C-6 and no special tools required!

C-6	Crawler "C"
Planetary Gears 3 hours	Gears and Bearings . . . 16 hours
Inside pinion and drive gear reduction . . . 11 hours	Top pinion from steering clutch with bearing and shaft 13 hours
Total 14 hours	Total 29 hours

Times shown are for removal and replacement of final drive with all components in place.

With a 15 hour saving for final drive replacement the "Euc" C-6 gives you 15 hours more productive time on the job! Easy accessibility that's designed into the C-6 and Euclid's time-tested planetary drive save hours of repair labor . . . that means less downtime and more production. Compare these savings in terms of lower costs . . . add the

extra hours available for work on the job . . . then you'll see what just this one advantage can do in cutting operating cost.

▲ The Euclid dealer in your area would like to prove that the C-6 is the lowest cost tractor in the 200 h.p. class . . . and the most versatile by far. He's sure of it, and wants you to know the facts, too!



EUCLID

DIVISION OF GENERAL MOTORS, HUDSON, OHIO
 Plants at Cleveland and Hudson, Ohio and Lanarkshire, Scotland



GOLD...soft, ornamental—hard master of man

In ancient times when gold was written स्वर्ण in Sanskrit, it was used for ornaments. However, it soon became a mark of status and wealth, and the search for gold changed the face of the world. New lands were discovered and populated with the word of gold discoveries.

The most common gold ores of that era were low grade, hard and abrasive igneous, sedimentary and metamorphic materials. Recovery of the gold was practical only because of the availability of slaves and conquered labor.

Mining gold ores today is a matter of high recovery at lowest possible cost. Exceptionally well-suited for this work are Symons® Cone Crushers. As a result, wherever gold is mined, as in all other important ore and mineral operations throughout the world, Symons Cone Crushers are first choice of major producers.

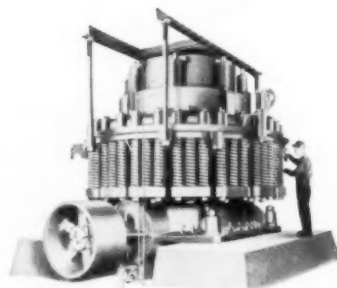
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C261

ATLANTA CLEVELAND DALLAS DULUTH HOUSTON KANSAS CITY MINNEAPOLIS NEW ORLEANS NEW YORK ST. LOUIS
SAN FRANCISCO TAMPA WASHINGTON WICHITA, KAN. TORONTO VANCOUVER JOHANNESBURG LONDON MEXICO, D. F.



SYMONS® CONE CRUSHERS
... The machines that revolutionized crushing practice ... are built in a wide range of sizes, for capacities to over 1500 tons per hour. Write for descriptive literature.



SYMONS ... a registered Nordberg trademark known throughout the world.



Jefferson Lake Plans California Asbestos Mine and mill to treat 2,500 tons of chrysotile daily

A 2,500-ton-per-day open-pit asbestos mine and fiber recovery mill are scheduled for construction and operation in Calaveras County, California at the location shown on the adjoining map.

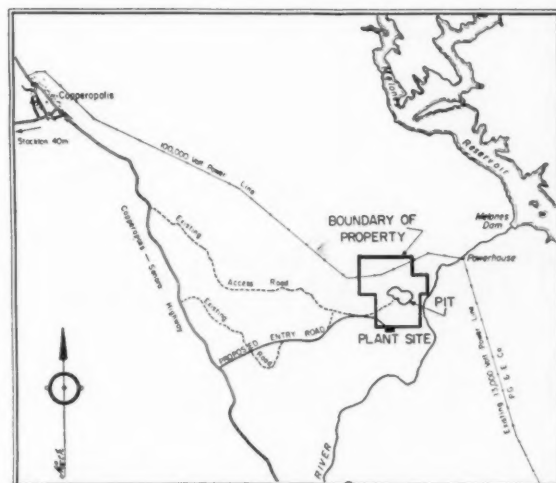
The operating company will be Jefferson Lake Asbestos Corporation, a wholly owned subsidiary of Jefferson Lake Sulphur Company of New Orleans, Louisiana.

Exploration over the last several years at the mine has indicated 17,000,000 tons of cross fiber chrysotile asbestos-bearing rock with the following fiber content by grades:

Group fiber	Percentage yield	Percentage proportion	Tons of fiber
4	1.0	16.0	170,000
5	1.5	24.0	255,000
7	3.8	60.0	646,000
Totals	6.3	100.0	1,071,000

Exploration consisted of 15,000 linear feet of surface trench 12 feet wide, and 70 diamond drill holes at the corners of 150-foot squares to an average depth of 453 feet. Seven check holes were drilled within squares. Cores were 2 1/8 inches in diameter with 94 percent core recovery. Ore was not bottomed by drilling. Only a few feet of overburden will have to be stripped for mining.

Cores were milled by the company and at an independent Quebec, Canada laboratory. It is relatively free milling with mainly soft fiber, but there is an appreciable amount of semi-harsh fiber. The company plans to blend



a few wide veins with shorter fibers to raise the quantity of its medium length production.

The new mill will be 100 feet high, have an area of 10,000 square feet, and will include primary crushers, conveyor belts, drying equipment, drydock storage facilities, secondary crushers, vibrating screens, suction hoods, fiber storage, and bagging facilities.

The mill will be built by the Tellepsen Construction Company of Houston, Texas for a firm maximum price of \$4,654,652.

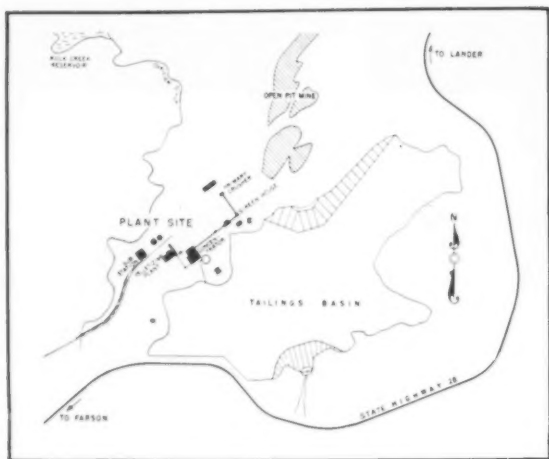
New Copper Mine for Newmont in South Africa as diamond drills outline major ore body



Newmont Mining Corporation and associates have completed surface drilling to prove a 300,000,000 tons of 0.70 percent copper ore body at their Palaborwa mine located at Palaborwa, Union of South Africa. See adjoining map for exact location. A large-tonnage pilot plant mill to recover the copper—azurite, malacite and chalcopryrite—as well as magnetite in the ore went into operation in March. An open pit mining plan has been formulated with a very, very low stripping ratio as the ore crops out over a large area. A program of underground exploration and bulk sample mining is now under way.

The large scale sampling program and pilot plant flowsheet determination are scheduled for completion in 1962. Meanwhile, Newmont's engineers as well as consultants are making evaluation studies in the United States for a 30,000 ton per day flotation mill, a reverberatory copper smelter with converters, and an anode casting department. Copper output would be about 200 tons per day with from 1,500 to 2,000 tons of Fe_3O_4 (60 percent Fe, 0.4 TiO_2).

Newmont's partners include Palaborwa Holdings Limited, Rio Tinto Company of South Africa Ltd., and Transvaal Ore Company Ltd.



ATLANTIC CITY taconite mine and plant will look like this in late 1962. Mine is at upper center, crushing plant at right, mill at lower left, and pelletizing at top left.

THIS PROJECT PLAN of the mine and plant pictured at left shows exact relation of buildings to each other, the water source, tailing dam, highways, and railroad tracks.

TACONITE—new iron ore for west as U. S. Steel builds at Atlantic City

by W. F. Pruden

Iron ore pellets from the West's first large-tonnage, fully integrated, ore-to-agglomerate open-pit mine, beneficiation mill, and pelletizing plant are only a little more than a year and a half away.

This is the Atlantic City project of the Columbia-Geneva Division of United States Steel Corporation near the ghost gold camp of Atlantic City, Wyoming where construction crews of the Pomeroy-Bechtel Joint Venture started work on June 30, 1960.

Hard, heavy, dense taconite—reportedly 300,000,000 tons assaying between 21.8 and 35.2 percent iron—will become ore by spending a reported \$73,000,000. Thus a new type of ore will be created in the growing West and the entire project reaffirms United States Steel Corporation's faith in the potential of the Western United States.

The Atlantic City ore body is a

metamorphosed pre-Cambrian sediment. The iron formation lies in a series of mica, sericite, chlorite, garnet, and staurolite schists with abundant greenstones. All of the metamorphic rocks are intruded by small diorite dikes and sill-like bodies. Gently folded, east-dipping Paleozoic sandstones and limestones cover the pre-Cambrian rocks about a mile east of the exposed ore body. The deposit outcrops along a hill which trends northeasterly and dips about 85° east. In the deepest drilling to date, any ore termination at depth has not yet been determined.

The long range mining plan as developed provides for removing the ore by conventional truck-shovel methods using truck haulage on 25-foot high benches with 37.5-foot wide safety berms left on every third bench. The average overall pit slope will be 45° with a stripping ratio of 0.45 cubic yards per ton of ore.

Because the iron formation at Atlantic City is so similar to the magnetic taconites in Minnesota as regards type and character of mineralization—practically, it is difficult to distinguish it from the Upper Slaty member of the eastern Mesabi Range—it was possible to take advantage of the experience gained there in translating drill core test data to projected plant practice.

The core composites were all tested

using the United States Steel's Oliver Iron Mining Division's standard methods for determination of magnetic iron content. In addition, representative composites were tested for concentratability and grindability.

It became readily apparent as testing progressed that in the upper portion of the ore body, and especially on the eastern slope, that there was a definite halo of partial surface oxidation believed to be the result of melting snow from heavy drifts. Consequently, the ore was divided into two classes—prime and oxidized. Prime ore was defined as material having a concentration ratio of less than 3 to 1 and a total recovery of more than 75 percent. Oxidized ore was defined as material having a concentration ratio of more than 3 to 1 and a total iron recovery of less than 75. Iron formation having a concentration ratio greater than 5 to 1 is considered waste and will be mined selectively and stockpiled as a lean ore reserve.

As a result of these studies and because the upper ore must of necessity be mined first, the mining plan was divided into two time phases; that is, the first six years of operation, wherein the major portion of the oxidized ore will be mined, and the remainder of the mine life, which will be in prime ore.

Late in 1956, preliminary engineering was started and it was de-

Mr. Pruden is chief engineer for the Columbia-Geneva Division, United States Steel Corporation, with headquarters in San Francisco, California where the plans and designs for the Atlantic City project were formulated and finalized. Details of this article are from a speech before the Association of Iron and Steel Engineers in Los Angeles, California.

cided to obtain a representative bulk sample of the ore body of sufficient size for full scale pilot plant testing; consequently, 3,000 tons of ore were mined from a 728-foot long adit crosscut driven across the ore body. This ore was shipped to the Pilotac plant of the Oliver Iron Mining Division at Mountain Iron, Minnesota. For control purposes, the ore was divided into two lots of 1,500 tons each to check variations in ore types.

On the basis of the tests performed on the drill core composites, it was believed that a typical Minnesota taconite crushing and grinding flow sheet could be employed; hence, this ore was crushed, ground, and concentrated at Pilotac in May, 1957, using commercial size equipment. As the result of this test, it was possible to obtain the data needed to firm up the design factors and at the same time assure management that the iron and silica content of the final shipped product would be as indicated by the concentratability tests on the drill cores. The concentrate produced in these tests was agglomerated by several different methods and further testing of the agglomerates was completed in a pilot plant blast furnace.

Upon completion of the full scale pilot plant tests, data was available to: 1. Develop the mining plan. 2. Determine the number of crushing stages required. 3. Fix the desired mesh-of-grind and determine the number of grinding steps and the types and sizes of mills required. 4. Outline magnetic concentrating and filtering characteristics and the equipment required. 5. Assist in the selection of the agglomerating method to be used.

In addition to the many characteristics of the ore and its process-

ing, there were several location and climate considerations which had a definite influence upon layout, design, and the methods used in handling the material in process.

The weather at Atlantic City is similar to that encountered in northern Minnesota, except for precipitation. It was apparent that one could expect hard freezing conditions from November to May. Because of the necessity to reclaim and re-use all water possible, and the known deleterious effects of the calcium ion on the balling characteristics of concentrates, the addition of calcium chloride to the ore to inhibit freezing had to be ruled out. To assist in the prevention of ore freezing in primary crushing plant bins, final crushing flowsheet and layout provides for the removal of all ore fines as soon as they are made. These fines are then added to the crushed ore prior to storage ahead of the primary grinding mills.

Because of the long periods of inclement weather, all processing buildings will be insulated and all working areas heated.

Water is, of course, a major factor of concern to all ore dressing operations and, in this arid section of the West, is of particular importance. As a result, the use of fresh water must be maintained at a minimum and complete facilities installed to recover to the maximum extent possible all of the water after process use.

Water runoff data for Rock Creek, the principal source of water, indicated that 50 percent of the available water is produced from melting snow that runs off during the month of May. In order to supply the plant with fresh water and process makeup water, which will average about 2,000

gallons per minute, a 2,800 acre-foot reservoir was designed for impounding this water during the spring runoff for use during the remainder of the year. Such a storage would have sufficiency in the worst three-year drought cycle during the past 50 years.

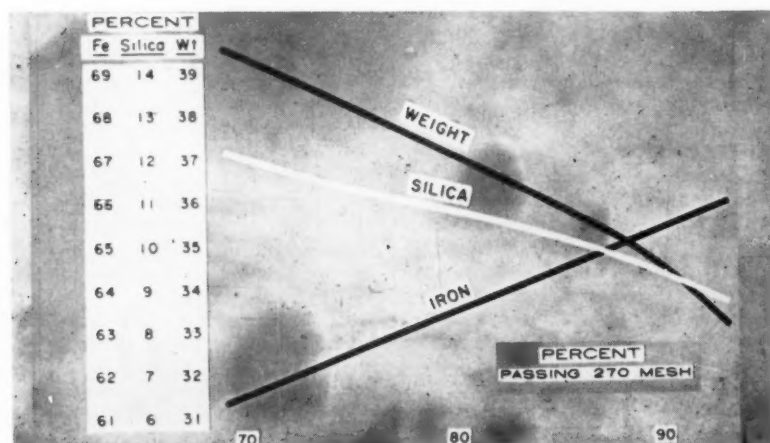
The plant is located at an average elevation of 8,300 feet above sea level. This introduces many processing problems. The effect of this altitude is better understood when one considers that the air at Atlantic City is only 75 percent as dense as at sea level and water boils at 196° F. As a result, it was necessary to derate all air cooled equipment such as electrical motors. Since the maximum attainable vacuum at this elevation is only 21 inches of mercury rather than the 30 inches at sea level, it was necessary to install filter area twice that required in a similar-sized plant at sea level. All internal combustion engines for trucks and railroad locomotives had to be specified to deliver the desired horsepower at this elevation.

The effect of the thinner air on the agglomerating operation was especially acute. Here it was necessary to increase the length of the machine by approximately 15 percent and increase the fan sizes by 20 percent. Since additional energy is consumed by these modifications, the kilowatt hour requirements per ton of product had to be appropriately adjusted over the amount used in a sea level plant.

Considerable wind and drifting snow are the normal winter conditions at Atlantic City; consequently, all buildings were designed with flat

continued on page 20

These curves show how finer grinds raise concentrate grade



A typical concentration curve, is shown to indicate the effect of grind upon the weight recovery of concentrate and the iron and silica content of that concentrate. As is common with typical magnetic taconites, the concentrate grade improves as the material is ground finer; for example, at a grind of 70 percent minus-270-mesh, the iron in the concentrate is 61.5 percent—at 90 percent minus-270-mesh it is 65.5 percent iron. Under the same conditions, the silica is lowered from 12 to 9 percent with a corresponding reduction in the weight recovery from 39 to 35 percent.

roofs and aligned with the prevailing wind to assist in self-cleaning and the prevention of build-ups of snow and ice and the safety hazards that result from slides. Precast concrete panels are installed along the lower six feet on the sides of all buildings as protection to the sandwich siding from snow removal equipment. Much attention has been given to prevention of moisture penetration at the outside walls of all buildings.

In the design of all portions of this project, considerable use has been made of models. These were of particular importance in the studies leading towards the actual operation of the plant. We believe that a model—

1. Permits three dimensional comprehensions of the complexities of the plant that could not be obtained without tedious review of the blueprints. This is particularly applicable to operations.

2. Assists in the study of the problems of maintenance in and around all equipment.

3. Provides for a detailed study of the operations and operator locations which could be reviewed on the models and results compared to actual job site studies obtained at the time of design.

4. Helps to solve many problems in material flow and equipment design prior to actual startup.

5. In addition, the models have been moved to the construction site to assist in scheduling and coordination of that phase of the work. They will also be used to help train operators and, finally, to explain layouts to visitors.

Public utilities in this area were of prime importance in the general plant layout since electrical power and fuel costs are major factors in an operation of this type. Electrical energy will come from the Pacific

Power and Light Company's new facilities at Glenrock, Wyoming. In addition, an emergency 1,000-kilowatt Diesel-electric generating plant will be maintained at the plant site. This unit is large enough to supply essential services and allow the equipment handling hot materials, such as the pelletizing fans, to be cooled without harm if the main source of power from the Glenrock area is lost. Natural gas will be supplied by the Northern Mountain Gas Company of Casper, Wyoming, through a pipe line about 25 miles long from the Beaver Field east of Lander, Wyoming.

The primary crusher is located at the center of gravity of the ore body. That is, 50 percent of the ore will be raised by conveyor to the screen house. The ore is conveyed uphill, through the fine crushing plant and into the fine ore storage bins ahead of the rod mills.

Elaborate plans made to store, reclaim, and conserve water

The contour of the ground made it possible to locate the concentrator on the side of a hill for gravity flow of ore and pulp through the mill. In addition, this location will provide for the discharge of tailings, both coarse and fine, directly to the tailings basin. By building a trestle across the tailings basin, fine tailing can be disposed of by gravity for at least 10 years without pumping. The coarse tailing will be disposed of by truck directly across the plant road into an area with sufficient volume for the life of the property.

The concentrate, as filter cake, will be conveyed to a higher level area which offered the only suitable site for the pelletizing operation and the related loadout facilities and railroad yards. Location of this portion of the plant was also influenced by the layout of the railroad and the entrance of the railroad spur to the facility.

A 2½-mile-long overflow ditch will extend from the reservoir on Rock Creek to the Slate Creek drainage, which in turn will return the water to Rock Creek. Fresh water for the plant is handled by a 20-inch line with gravity flow to the main pump house located near the concentrator. Fine tailing, after thickening, is transported through a gravity pipe line to the South dam. The line to the North dam is also by gravity in the early years. Return water from the tailing basins is settled after decantation and returned to the concentrator

over the tailing trestle. Except during emergency, no water will be discharged from the tailing basins into the Rock Creek flowage.

Much effort has been devoted to the control of dust and fumes. Each building has been considered as a separate problem in ventilation and adequate air changes have been incorporated to produce a clean and cool working area. Wherever air is withdrawn from a building area, adequate provision has been made for this volume to be brought into the building under controlled conditions. In all blind areas, air will be moved under positive control.

Many types of dust collectors have been selected for the plant; however, wet collectors and bag collectors have been specified wherever possible to avoid the discharge of dust into the atmosphere. In no case will the collectors exhaust into a building area. The individual systems will be balanced to achieve the proper carrying velocity. All ducts will have blast gates for final velocity balance which will be made in the field.

All sources of dust have been analyzed and provision made to prevent any discharge into a working area. Removal of dust alone is not sufficient. In all cases adequate air is supplied to each exhaust system to prevent a pressure drop in the area from hindering the operation of the fans.

A central maintenance shop will be operated on a 24-hour, 7-day

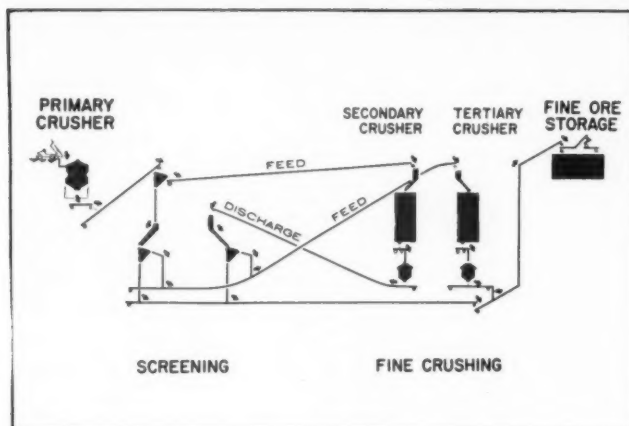
schedule. In this shop, all the equipment necessary to maintain the plant will be installed. Each operating area is equipped with a maintenance section from which assigned maintenance crews will work.

In addition to the design of a mine, crushing plant, concentrator and pelletizing plant, it was necessary to consider how the product would be handled through the ore storage yards to the blast furnaces at the Columbia-Geneva blast furnaces at Provo, Utah. Although this plant is adequately supplied with unloading, screening, and blending facilities for the present ore shipments from southern Utah, these were not considered to be entirely suitable or adequate for the pellets from Atlantic City.

To complete a job of this magnitude within 24 months in this location, especially with the weather prevailing at Atlantic City, seasonal factors must be recognized in the construction schedule. It is essential that all structures be enclosed by November 1, 1961, so that process machinery installation can be completed during the winter of 1961-1962 to permit completion and initial production in the last half of 1962.

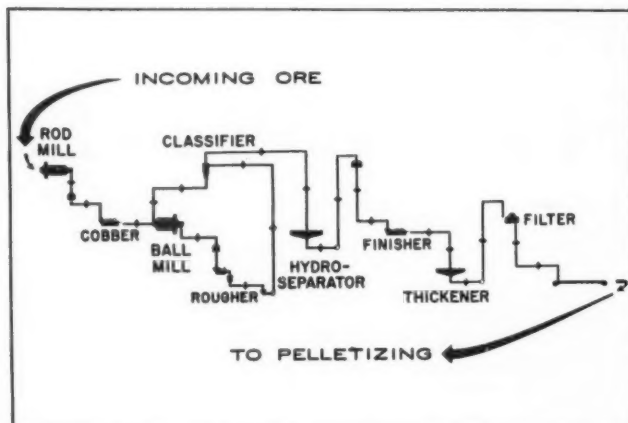
In summary, the engineering has been completed, the construction is underway, and Columbia-Geneva now looks forward to a mine and mill which will produce a high-grade pellet for the Geneva blast furnaces.

Crush in three stages: gyratory and 4 cones to minus- $\frac{3}{4}$ -inch



The mined ore will be crushed in a 54-inch gyratory with a closed side setting of 6 inches. This product will be screened into plus- $\frac{1}{2}$ -inch and minus- $\frac{1}{2}$ -inch fractions. The minus- $\frac{1}{2}$ -inch portion will be further screened to remove the minus- $\frac{3}{4}$ -inch ore. The plus- $\frac{1}{2}$ -inch portion will be second stage crushed in two 7-foot standard cones and then screened to remove the minus- $\frac{3}{4}$ -inch material. The combined plus- $\frac{3}{4}$ -inch oversize from the two screens will be put through the third stage crushers, two 7-foot short head cones whose product will be combined with the final undersize from the other screening operations and conveyed to the rod mill feed storage bins.

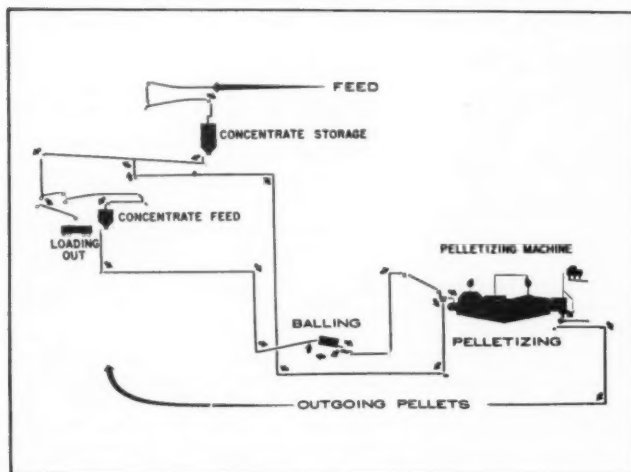
Rod and ball mill grind with three-stage magnetic separation



The Atlantic City concentrator will incorporate three milling circuits operating in parallel. Each circuit will consist of one 10.5- by 15-foot rod mill for primary grinding followed by two 10.5- by 15-foot ball mills with the subsidiary magnetic separators, classification, and filtering units.

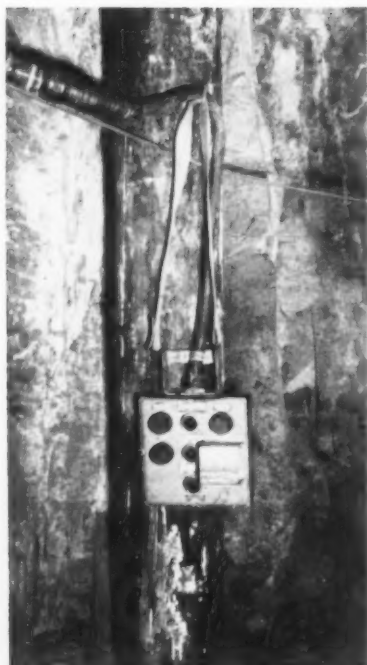
In the concentrator, the $\frac{3}{4}$ -inch ore is ground by the rod mills and then magnetically separated by the cobbbers. The ball mill grinding is in closed circuit with rougher magnetic separators and cyclone classifiers. After grinding, the pulp is deslimed and passed through the third stage magnetic separators—the finishers. Thickening and filtering complete the operation.

Form pellets with balling drum for traveling grate firing



Because of the filtering problem at this elevation and the need for uniformity in filter cake moisture, if good pellets are to result, a system was designed to provide storage for 36 hours of feed to the pelletizing plant. This storage will stabilize the balling operation and assist in obtaining a uniform product. This plant will have two separate processing units operating in parallel, each with three balling drums and one 6-foot wide, 32-wind-box pelletizing machine similar to those in use at Reserve Mining Company's taconite plant at Silver Bay, Minnesota.

After blending, the filter cake will be fed to a balling drum operating in closed circuit with screens. When a green ball is of a sufficient size, approximately $\frac{1}{2}$ -inch in diameter, it will leave the circuit and pass to the pelletizing machine. On this machine, the green balls will be dried, heated to approximately 2,400° F. and then cooled prior to discharge.



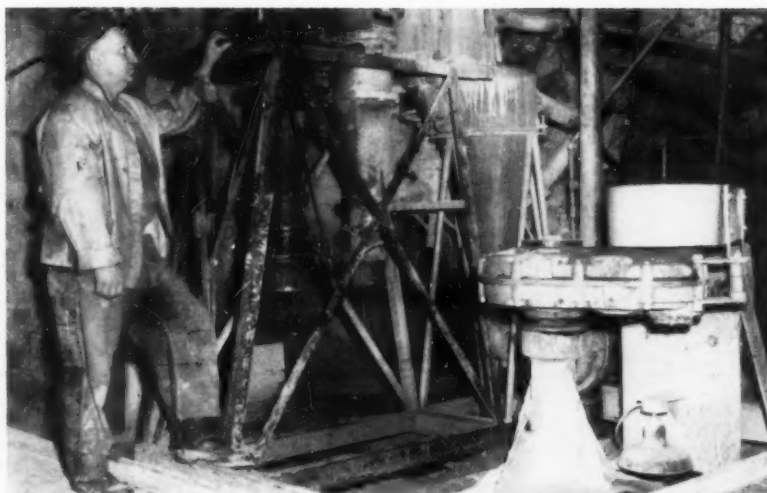
SQUARE CONTROL BOARD has buttons for water and air (left), lights to advise the capacity of the sand storage tank (center vertical line), sand button (top right), and mill pump button under shield (bottom right).

The Lucky Friday mine, in the Coeur d'Alene district of Idaho, has a unique system that practically automates the job of pumping sand fill to stopes. By punching buttons on a small portable control board in the stope, one man starts and stops the sand flow, flushes and cleans the system, and regulates the mill tailing pump. Lights on the board tell the capacity of a sand storage tank on the main adit level of the mine. With this new remote control innovation, back filling of horizontal cut and fill stopes in the Lucky Friday silver-lead mine is done more quickly and efficiently than ever before.

Stope sealed with burlap sacks

Sand filling of stopes became possible at the Lucky Friday when their new 500-ton mill was completed in February 1960. This assured a ready source of classified mill tailing that could be placed faster and cheaper than other materials, and made a tighter fill.

After a horizontal cut has been made, the stope is prepared for back-filling by sealing off the raise cribbing and any wood flooring with burlap sacks. Ore chutes are temporarily



MINE SUPERINTENDENT Dave Elder at the sand storage agitation tank on the main adit level of the Lucky Friday mine. Krebs cyclones dewater the mill tailing as it comes through the four-inch pipe at top right.

At the Lucky Friday Mine . . .

Pumping Hydraulic

laced off. This is necessary for safety, and to prevent water and sand seepage. A two-inch standard iron pipe that will carry the sand fill is then positioned. This pipe is connected at the shaft to a two and one half-inch rubber-lined pipe that comes from the underground sand storage tank on the adit level of the mine. All pipe sections are coupled with Victaulic fittings. The average stope to be filled measures 60 to 100 feet long, 5 to 12 feet wide, and 8 to 10 feet deep.

Sand filling is fast and efficient

Once a stope is ready and the sand storage tank filled, only one man is needed to start, control, and stop the sand filling operation. This is accomplished by the use of a portable remote control unit operated by the sand man in the stope being filled. Two types of remote control units have been used. The first required a size 16, twelve-conductor cable from sand storage tank to stope with 110 volt signals transmitted over separate circuits. The two types of lightweight transmitting control panels used with this system are shown at left. The heavy 12-conductor cable used in this system was expensive and diffi-

cult to handle in the raises and stopes, however. To overcome this handicap, the system presently in use was then developed in collaboration with Orbitran Company, Inc. and is patterned after remote control systems used on underwater television cameras. Four signals are transmitted each way over a single two-conductor, Type SO, Size 16 cable, utilizing 1,000 to 5,000 cycle tones and transistor operated relays. The receiver and transmitter units were developed by Orbitran to company specifications and perform the same functions as the earlier system. Functions indicated on the control panel are as follows:

Lights to show (a) that the sand storage tank is full; (b) that the storage tank is empty; (c) that the tank agitator is shut down; and (d) that the slurry valve under the tank is open.

Control panel to tank signal operations are:

1. Push button to operate a solenoid valve controlling water pressure to jacket of main sand pinch valve.
2. Push button to operate a solenoid valve controlling air purge to sand line.



STOPE PREPARATION is done by two men who lace off chutes, and seal area with burlap to prevent water and sand seepage. Stulls are for temporary support of hanging wall.



AFTER FILLING stope with sand through pipe at bottom, four to six hours are needed before it solidifies. About 5,000 tons of sand fill are placed monthly in the mine.

Fill to Stopes Is Semi-Automatic

3. Push button to operate a solenoid valve controlling sand line flush water.

4. System shut down button to operate a solenoid valve controlling an air cylinder at the mill pump. This air cylinder moves a funnel diverting the slurry from the pump to the tailings line. An automatic flushing cycle is initiated at the same time to replace the slurry with water and clear the system from mill to tank. The mill to tank system is manually started by mill personnel.

Hydraulic fill flows through the line to the stope at a rate of 40 to 50 dry tons per hour. Slurry from the cyclone enters the tank at approximately 16 tons per hour.

Fill dewatered at storage tank

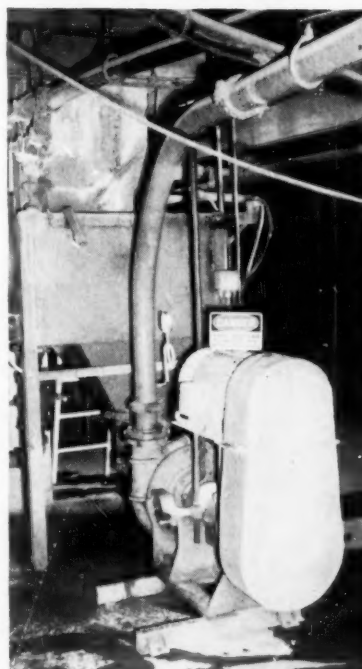
Approximately 80 percent of the Lucky Friday mill tailing is pumped to the mine for sand filling. When fill is required, tailing is pumped by a 4- by 4-inch Hydroseal pump through a four-inch pipe line. When not required, the mill tailing is diverted directly into the tailing line.

On the adit level of the mine, approximately 900 feet from the pump

in the mill, the tailing sand is pumped by a 3- by 3-inch Hydroseal pump through two Krebs D10B cyclones for dewatering. The slime overflow is returned to the normal mill tailing line, and the sand fill (now 68 to 70 percent solids) drops into the sand storage tank cut from the rock. This tank measures 17 feet in diameter by 18 feet deep, and holds about 120 dry tons of sand. A Galigher agitator powered by a 30 horsepower Century motor keeps the sand mixed so that it does not pack in the tank. Several air jets are also provided to assist in agitation when needed.

It takes two to three hours to fill an average stope with sand, and four to six hours for the sand to solidify sufficiently for mining to continue. Approximately 5,000 tons of hydraulic sand fill are placed in the mine stopes each month. This is done at a cost of about 70 cents a ton of extracted ore versus a former \$2.50 a ton when other fill was used.

Staff at the Lucky Friday mine includes Dave Elder, mine superintendent, Wray Featherstone, assistant mine superintendent, Ben Holdaway, mill foreman, and William Folwell, mining engineer.



MILL TAILING is pumped into mine. Change from tailing line flow to mine is by push button signal from mine.



TRUCK-SHOVEL teams moved the blasted rock to expose the Craigmont ore body. Here a new Bucyrus-Erie 88-B Diesel shovel with a five yard bucket loads one of the 14 Euclid 27 ton Diesel trucks. Two 2½ cubic yard Northwest 80D shovels were also used for stripping. This is first rock cut and it shows mixture of soil, boulders, and blasted rock.

CRAIGMONT completes copper mine

Open pit copper mining has been started by Craigmont Mines Limited at its new open pit copper mine in southern British Columbia after more than 4,000,000 cubic yards of waste—overburden and rock—had been contract stripped.

Both open pit and underground mine development are on schedule, as is the construction of the 4,000 ton per day flotation mill and auxiliary facilities. Craigmont is scheduled to join the ranks of the major copper producers by early autumn, just 3½

years after the ore body was indicated by geophysical prospecting in the spring of 1957. The ore body was actually discovered by a diamond drill hole under the magnetic anomaly in May 1957.

This geochemical and magnetom-



CATERPILLAR DW21 scrapers were used for stripping the heavy, dense, consolidated clay or glacial till containing many large boulders which covered the bed rock. Nine DW21's were used for this stripping and to clean off pockets and narrow runs of overburden filling irregular pockets in the rock, so that the drills could be moved in for blast holes. A scraper has just dumped load in picture and it will be dozed over bank by the two D8 bulldozers.



WASTE DUMPS are built up adjacent to the open pit. Here are two Euclids dumping into a steep ravine. Average waste haul was 1,100 feet. The steep hillside which rises from the 3,200 foot bench to the 4,260 bench made it possible to establish several dumps to dispose of the plus-2,000,000 cubic yards of soil gravel and the 1,500,000 cubic yards of rock waste.

stripping; moves in new mining equipment

eter discovery was hailed by MINING WORLD as the Geophysical Discovery of the year. Franklin Price and R. E. Renshaw wrote an article describing the original discovery work, which was published in the July 1958 issue of MINING WORLD.

When Craigmont Mines took over ore production in mid-March after the contractor, Kie Mines Ltd. (a subsidiary of Peter Kiewit Sons Co. of Canada Ltd.) had completed stripping, Craigmont's own mining equipment was ready. This included

three P&H 4½ cubic yard Diesel shovels, 14 27-ton end dump Euclid Diesel trucks, a Bucyrus-Erie 40 R rotary blast hole drill, one Ingersoll-Rand Drillmaster, and one Gardner-Denver AirTrac.

During stripping the contractor

RIPPING the densely packed and frozen overburden necessitated two Cats most of the time. All overburden was ripped ahead of the scrapers. Ripper points wore out in only nine hours at first. However, the use of new Esco alloyed carbon steel points increased life to 40 hours. The same steel raised shovel teeth life from 40 to 150 hours, and increased scraper cutting edges from 350 to 1,000 hours. Ripping Cats push-loaded the scrapers.



had removed and stockpiled 79,450 tons of low grade ore and exposed the apex of the ore body in numerous places for Craigmont mining. The widths and grades of the ore body, as exposed, were about the same as predicted by Craigmont's geological consultants—Chapman, Wood & Griswold Ltd. of Vancouver, British Columbia.

The main ore body will be pitted above the 3,500 foot level over a strike length of about 2,200 feet and for widths up to 230 feet. Open pit ore has been estimated at 8,635,000 tons assaying 1.82 percent copper and 19.2 iron (magnetite).

The 4,000 ton per day mill is being built on a site bulldozed out of the side of the mountain at an elevation of 2,400 feet. This means that the pit ore must be transported downhill to the stockpile area and mill bins. A 5,800 foot long, 30 inch wide cable belt conveyor built in Scotland by Cable Belt Ltd. is being installed between the pit primary crusher and the stockpile for ore transport.

An Allis Chalmers 42 by 65 inch gyratory crusher will be used at the head of the belt where a 4,200 ton surge pile of ore will be maintained. The mill stockpile will be 11,200 tons so that the mine can operate on a five day week and the mill seven

days a week.

The Craigmont ore body is considered to be a structurally controlled, pyrometamorphic replacement and breccia filling of impure limestone. Magnetite and hematite comprise about 15 percent of the ore by weight. Chalcopyrite is the main copper mineral, accounting for almost all of the copper and sulphide.

While the open pit will supply mill feed for several years, Craigmont has carried on an active underground exploration program since July 1958 with adits at the 2,400, 3,000, and 3,500 foot levels. The 3,500 foot adit is 3,448 feet long with six cross cuts totalling 1,705 feet driven

Use Champion rotary for nine inch diameter holes 73 feet

With a bench height of 66 feet specified for stripping, a large drill was required for deep holes, so the

Joy Champion rotary drill pictured at left was converted to drill a nine inch diameter hole. A 900 cubic foot



per minute air compressor on the drill blew cuttings to the surface. These holes, all vertical were drilled seven feet below grade for a total depth of 73 feet. Spacing averaged 35 by 35 feet on a regular pattern. Use of ammonium nitrate for blasting many of these holes proved impractical, as underground springs filled the bottoms of many of them with water. Therefore a mixed load of slurry (70 percent of the hole) and ammonium nitrate (30 percent) was used. The bottom of the hole was loaded with 50 pound bags of Hydromex slurry manufactured by Canadian Industries Ltd. and the slurry column was raised to a point above the water zone. The remainder of the hole was then loaded with job-mixed ammonium nitrate-Diesel oil prills to a point within 20 feet of the collar.

The Hydromex was detonated by

Kolman conveyor fed by

To speed loading of overburden and keep the shovels loading in broken rock, a 48-inch Kolman Conveyor was set up on one of the main benches. This conveyor was set on one wing of the bench well out of the way of the shovel and trucks.

While this conveyor had the disadvantage of being set in one place for a considerable time, it had the greater advantage of a high loading capacity. In fact, when the dozers could push enough dirt and rocks to it the loading rate was higher than was being achieved by a 2½ cubic yard Diesel shovel.

The picture at left shows an International Harvester TD 25 push-



through the ore body; the 3,000 level is 6,062 feet long, and the 2,400 (mill level) adit was 1,435 feet long early in March.

This underground development plus 82,242 feet of underground diamond drilling and 24,742 feet of surface drilling has proven 18,608,000 tons assaying 2.09 percent copper and 20.3 percent iron, and indicated 3,967,000 tons of probable ore assaying 2.06 percent copper and 16.1 percent iron. Ore has not been bottomed in the drilling below the 3,000 foot level in the syncline ore body, but further information in depth must await completion of the 2,400 adit and drilling from that level

to probe lower horizons.

Detailed design of the flotation mill has been done by Wright Engineers Ltd., Vancouver, British Columbia to specifications of the engineering staffs of Canadian Exploration Ltd.

Grinding will be done in rod and ball mills with the latter in closed circuit with Krebs 20D cyclones. Five rougher flotation circuits will use 18 cell No. 48 Agitair machines with cleaning in three banks of 10 cell No. 24 Denver Sub-A machines. Concentrate will be cycloned, thickened, and filtered. Tailing will be thickened and reclaimed water recirculated. The initial flowsheet makes no provision

for magnetite recovery, but tailing will be stored for possible future iron recovery.

The Craigmont company is controlled by three other companies: Canadian Exploration Ltd., the operator and largest holder; Noranda Mines, Ltd.; and the United States firm, Peerless Oil & Gas Company.

Operating personnel at the mine 10 miles north of Merritt includes R. G. Duthie, general superintendent; R. E. Hallbauer, mine superintendent; R. L. Hannay, mill superintendent; W. A. Triggs, chief engineer; C. C. Rennie, senior geologist; and J. M. Anderson and A. M. Laird, mine engineers.

deep; Gardner-Denver AirTrac used for trim and toe holes

a Pentomex primer placed in the bottom bag. To ensure detonation of the entire charge, 2 by 16 inch cartridges of 75 percent Forcite were chain loaded at five-foot intervals from bottom to top. The bottom primer and all cartridges were tied together by Primacord. All holes were stemmed to collar with cuttings.

The Gardner-Denver AirTrac, mounting a 3-inch drifter, proved a most versatile drill for maneuvering over the rough surface of the solid rock exposed by stripping. The unit is pictured at right drilling 20 foot deep vertical holes during the winter stripping. The boxes of 75 percent Forcite used for loading the holes pretty well outline the pattern.

The bench walls were maintained at a 70° slope to minimize caving. The AirTrac with its tilting sash was used to drill angle holes for bank trimming and it was also used many

times for toe drilling.

Average powder factor for all drilling and blasting was 1.0 pound

per cubic yard, which produced good fragmentation—much of it minus-6-inches.



dozers loads three trucks

ing overburden down the slot to the top of the conveyor loader. Note the rippers which were used almost continuously ahead of dozing. By using the dozers, effective stripping and loading range of the conveyor was extended to several hundreds of feet.

The picture at right shows how the conveyor was set up so that the trucks pulled right under it for loading without backing. This resulted in a high tonnage factor for each of the three trucks used with loader.

The picture also shows how shovel was used for loading rock while the dozers pushed overburden off the top of the rock to expose it for blasting ahead of shovel loading. END





IBM 650 COMPUTER of the Numerical Analysis Laboratory is admired by representatives of the Anglo-American and R. S. T. mining companies of Northern Rhodesia.



EXPLORATION APPLICATIONS for computers and underground ore reserve estimations were detailed by geologist Dr. Willard C. Lacy of the College of Mines.

Computer Seminar Emphasizes Value of

Terrific! Outstanding! Smashing! These were some of the superlatives heard at the University of Arizona during the recent short course on computers and computer applications in the mineral industry.

Given by the College of Mines and the Numerical Analysis Laboratory in Tucson, Arizona, the four-day course generated terrific enthusiasm among the engineers present. When they returned to their offices on completion of the program they were inspired with fresh ideas, and a new approach on how to handle some of their problems.

Professor Elmer R. Drevdahl of the Department of Mining and Metallurgical Engineering organized the seminar, and originally planned for a probable attendance of 20 or 30. However, final registration on April 4 totalled more than 100 men from over 50 organizations in the United States, Northern Rhodesia, Canada, England, Mexico, and Venezuela.

The use and diverse applications of electronic computers in mining was presented in 20 authoritative papers given by faculty members of the university and professional consultants. These lectures covered every-

thing from basic fundamentals of computer design and operation, to specific applications in exploration, mining, metallurgy, and allied fields. Some of the interesting papers on the program were: "Introduction to Computers," "Principles of Computer Programming," "Use of Computers in Equipment Analysis," "Application of Computers to Open Pit Ore Reserve Estimation," "Underground Ore Reserve Estimation," "Computers for Process Control," "Application of Computers to Metallurgy," "Determining Pit Limits and

Some of the men who attended the Arizona program . . .

O. T. Berge—chief mining engineer, Erie Mining Company, Minnesota, "The Arizona College of Mines faculty should be complimented on an excellent presentation of a very thought-provoking subject. The use of computers should prove to be of significant value to the mineral industry."

B. Arnulfo Bernal—Dirección General de Minas y Petróleo, Mexico City, "The Mexican government is planning to modernize their records of mineral production and related statistics to cut costs and increase efficiency. With my reports the government will know better what steps to take."

Joseph J. Brubaker—division industrial engineer, Kennecott Copper Corporation, Hurley, New Mexico, "The seven of us from Kennecott's New Mexico operations are here to learn. We have started to send computer problems to service centers and we wish to know the full potential of this new tool."

D. Cottier—liaison officer; **W. Cowie**—business manager; **C. Halliday**—assistant manager, Northern Rhodesia Copper Mines of the Anglo-American and R.S.T. Groups, "We cannot afford not to know what computers are about, and what they can do for the copper mining industry in Northern Rhodesia."

John Evans—evaluation engineer, Canadian Exploration Ltd., Vancouver, Canada, "I want to see if computers can be of assistance to us from the exploration standpoint. This is a terrific show, well sponsored, and of great value."

J. J. Coile—mine engineer, Anaconda Iron Ore (Ontario) Ltd., Canada, "We have little background in this field and want to find what applications we might use."

D. D. McIntyre—mineralogist, Union Carbide Nuclear

Company, New York, "My interest is in statistical analysis of geological problems. We have an IBM 7090 and I now visualize new applications to our diverse problems."

Francis J. Melly—computer coordinator, Kennecott Copper Corporation, New York, "The purpose of my attending is to keep abreast of developments in utilization of computers in the mining industry, and their possible interrelationship with accounting and financial planning activities."

James Minette—mining engineer, U. S. Borax, Boron, California, "We are very interested in application of computers for pit planning, grade control, and equipment analysis."

Desmond Oxford—computers project manager, Anglo-American Corporation, Northern Rhodesia, "To gain information on applications, particularly as it affects mining. To that end I attended a computer convention in Rome, spent time in Great Britain and the United States. I have to advise on the suitability of a computer for our African operations."

Warren K. Pincock—ore control engineer, Phelps Dodge Corporation, Bisbee, "This conference points up one important facet—that of communication between the computer people and the mining people. Each has to have an understanding of the other. I feel this conference has helped a great deal."

Dr. John N. Faick—geologist, American Exploration & Mining, Tucson, "I have obtained satisfactory results from the application of computers to the solution of ore reserve and grade problems for small mines."

R. J. Hawkanson—chief mining engineer, Pickands Mather



RICHARD F. HEWLETT, research fellow of the College of Mines, presented three comprehensive papers on electronic computer applications to mining problems.



DISCUSSION GROUPS on various computer topics were held during the evening hours, and were well attended by engineers of over 50 mining companies from six countries.

Data Processing to Mineral Industry

Pit Expansions," "Use of Computers in Exploration Projects," "Mathematical Models and Their Application to Production Problems," "Application in Allied Fields," "Justification and Preparation for Computers," "Administration of Computing Activities," and "Computer Pitfalls."

One of the highlights of the program was a guided tour of the Numerical Analysis Laboratory on the University campus. This computer center, under the direction of Dr. A. Wayne Wymore, is equipped with an IBM 650 digital computer which has

been used to solve many mining problems in western United States. The operation of this general purpose computer, as well as laboratory procedure and practice, was generously explained by staff members to an extremely interested audience. Evening hours were occupied by discussion groups conducted in various classrooms by members of the College of Mines staff. A small analog computer used by the Chemical Engineering Department of the university was also demonstrated.

No one knows what future impact computers will have on the world

mining industry. However, the importance and potentialities of computers were amply demonstrated at the many thought-provoking sessions. It was generally agreed by the engineers present that a computer is not a substitute for man's reasoning ability; but if properly used and understood, it can (a) handle a greater amount of data processing work, (b) render better decisions, and (c) generate more ideas than heretofore thought possible.

Because of the keen interest and enthusiasm shown, tentative plans are now being made for future seminars.

Why they came, and what they think of computers . . .

& Company, Montreal, Canada, "I am here to determine the use of computers in estimating complex ore bodies. The course is very well organized and presented, and the ideas learned here will aid us in further work along these lines."

Parke A. Hodges—vice president, **Behre Dolbear & Company**, New York, "I think that this concept is something new that has not been given enough consideration by the industry. I came here to investigate computers at first hand."

Frank A. Keith, Jr.—chief engineer, **The Anaconda Company**, Weed Heights, Nevada, "I came to investigate computers as a new tool, and see if there are applications to our company-wide operations. I feel there are definite possibilities."

Kenneth Lane—operations research, **Rio Tinto**, London, England, "Our interest is in operations research and the application of modern mathematical and computer techniques for improving the efficiency of our mines."

Michael Martin—chief mining engineer, **Pima Mining Company**, Tucson, "Pima has used the computer to help find the economic limits of a small pit expansion. They are anxious to learn more about the possible uses of the computer in the mineral industry and to keep abreast of new developments."

O. E. Pothier—director mining operations, **J. R. Simplot Company**, Pocatello, Idaho, "Considerable publicity has been given to the use of the computer as a tool for the mining industry. This school was an opportunity to find out if there was an application for our use."

Donald Pruss—president, **Geodynamics, Inc.**, Los Angeles, "It is encouraging to know that the mining industry has now been formally introduced to simulation. Great strides will come from application of the simulation technique, particularly to locating new reserves and to optimize conditions of development and exploitation of known reserves."

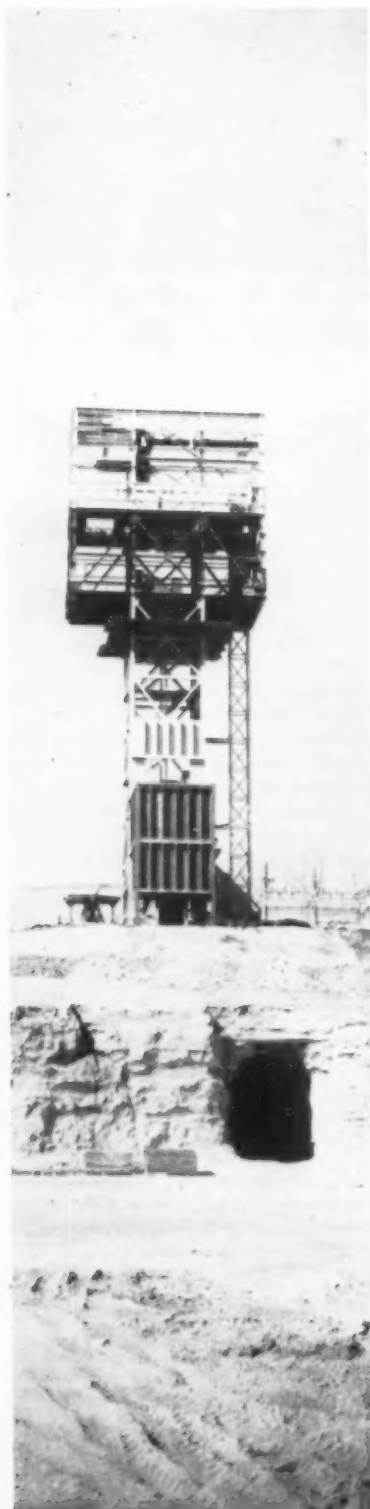
Charles Reynolds—chief engineer, mine engineering division, **Orinoco Mining Company**, Venezuela, "We are interested in applications of these statistical techniques to improve our operations from the standpoint of grade control and tonnage estimations. I am surprised at the attendance and interest, and am enthused on the future of these techniques."

Karsten Rist—long range procedures engineer, **Climax Molybdenum**, Leadville, Colorado, "The computer, being a tool of operations research, has a great deal of potential for several of our problems at Climax. We now have to find the method of solution."

LeRoy Scharon—consulting geophysicist, **National Lead Company**, Missouri, "Up to now my work with computers has been in the analysis of geological data. We are now interested in the wider use of computers for rapid evaluation of statistical data involving current operating mines, exploration areas, and investigation of mineral deposits."

Next Month: **SPECIAL ISSUE ON HOW COMPUTERS CAN HELP YOU IN EXPLORATION, MINING, METALLURGY**

MERAMEC—New Underground Missouri



No. 2 SHAFT HEADFRAME is 178 feet high. Ore will be conveyed out tunnel.

Meramec Mining Company's new 12,000-ton-per-day deep underground iron ore mine at Pea Ridge, Missouri, is right on schedule. Plans call for first shipment of high-grade pellets in 1963.

Meramec, a joint St. Joseph Lead Company-Bethlehem Steel Company project, combines St. Joe's geologic and mining skills with Bethlehem's beneficiation, pelletizing, and marketing skills.

The buried pre-Cambrian magnetite ore body was discovered by drilling an airborne magnetic anomaly. St. Joseph Lead Company drilled the anomaly seeking lead in the Bonne Terre dolomite in 1953. No lead was found, but the holes were continued to the pre-Cambrian rhyolite porphyry where a major magnetite ore body was found apexing 1,400 feet below the surface and extending to a depth of more than 3,000 feet. Twenty-seven deep drill holes indicated a possible 100,000,000 tons. In 1957 Meramec Mining Company was formed to bring the deposit into production and Earl Bilheimer was appointed resident manager.

The No. 1 man and service shaft had been sunk 2,420 feet in early March and the 2,425-foot level station and skip pocket was being cut. The shaft will be temporarily bottomed 50 feet below the level, while a major program of level development and stope preparation will be carried out through this shaft. Two eight-ton skips and a center man and service cage will be installed as soon as the shaft steel has been installed to the 2,425-foot level. The new double-drum Nordberg hoist is installed and ready for use. The Ottumwa sinking hoist will be retained and used as the man-cage hoist. While this shaft will

be the mine's service shaft, it is being equipped with skips for hoisting development waste and of course has been the location of first level development—the 1,675-foot level. Both drifting and sinking were carried on simultaneously.

At the No. 2 shaft, 820 feet away, also in the footwall of the near-vertical ore body, the 1,995 level station has been completed, and the shaft sunk 2,100 feet deep. This will be the ore hoisting shaft, using two five-rope Koepe wheels mounted in the top of the 178-foot-high steel (Bethlehem) headframe.

Details of the hoists and skips for the two shafts are shown in table. Of special interest is the use of rope guides (the first in the United States for the skip and cage counterweights). Both shafts are round, 22-foot rock section, 19 feet one inch diameter inside the concrete lining. In No. 2, four conduits in the concrete will carry electric cables. Two six-inch pipes will each house one three-conductor high voltage cable, and two eight-inch pipes will carry five 37-conductor ore hoist signal cables and two 26-pair intercom cables. Hung inside the lining from steel buntons will be one 12-inch compressed air line and one six-inch concrete line. This concrete line has been used while sinking the shafts and as high as 93 cubic yards of concrete have been dropped and placed in 5.5 hours.

At the No. 1 shaft, 3,200 feet of 9- by 9-foot development have been driven: The 9- by 9-foot crosscut to the ore body, and a drift along the center of the ore to the southwest and northeast. Every 200 feet in this drift, diamond drill stations were cut and four drills have operated three shifts

Hoist and Skip Details at Meramec Mining Company

Shaft	Purpose	Skip	Hoist	Rope	Rope Speed
No. 1	Waste	Two 8-ton in balance	Double-drum Nordberg 144-inch diameter by 85-inch width	13¼-inch Bethlehem	1,200 feet per minute
	Service	One 5 by 14-foot cage	Ottumwa, double-drum	13g-inch	800 feet per minute
No. 2	Ore	Two skips, each with counter balance Skip weighs 19 tons and will hold 19 tons of ore 28.5-ton counter-balance 2,650 feet per minute hoisting speed	Koepe-type, Canadian Westinghouse, 2,250 horsepower Two 144-inch diameter drums grooved for five ropes	Five 1¼-inch	2,650 feet per minute
	Service	One 6,000-pound cage with 6,000-pound load, 9,000 pound counter-balance	One 96-inch-diameter drum grooved for two ropes	Two 1-inch	1,250 feet per minute

Iron Mine

per day to drill a ring of holes from each station. This drilling and core analysis have determined the size, shape, attitude, grade, continuity, and variations of ore types of the deposit.

This has been important data for mine planning, determination of a stoping method, and mining sequence. Remember that these detailed facts about the ore body have just been determined by this closely-spaced drilling so that studies and evaluation leading to a mining method are now being made. Block caving, sub level caving, long hole breaking for shrinkage stoping, and several other mining methods have been considered.

Basically, the plan is to mine a 600-foot-high block of ore below the 1,675-foot level, leaving about a 200-foot-high crown pillar.

The ore body is large enough to block cave and the walls are hard, so this method would have a cost advantage. However, the overlying sediments contain three aquifers including those at the bottom and top of the La Motte sandstone, so district pre-draining would be a prerequisite for this type of mining.

Sub-level caving would have the advantage of a closer waste cut-off and would permit recovery of some ore bulges into walls. Long hole blasting and shrinkage would have the advantage of wall support until the stope was pulled dry.

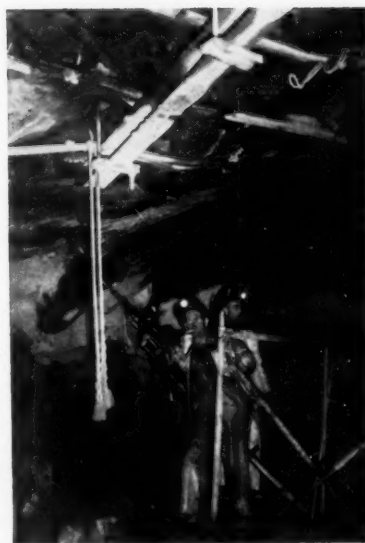
Now that No. 1 shaft has been sunk to the 2,425-foot depth (the hoists now installed are designed to be operated at a depth of over 3,000 feet), the main skip loading pocket is being completed below the 2,275 level. The main skips will be installed in the shaft as soon as ore and development rock pockets are completed below the 2,275-foot level.

The 26-mile-long branch line of the Missouri Pacific Railroad was completed to the mine and the first train arrived February 4. With most of the grading for the beneficiation and pelletizing plant completed and construction plans being finalized, the No. 1 shaft virtually completed, the No. 2 shaft sunk almost to the initial depth, and the contract awarded for the crushing plant foundations, Mearns has completed initial construction and is ready for a busy two years before the mill starts.

Resident manager Earl Bilheimer and assistant manager R. G. Peets plan to keep the project on schedule.



No. 1 SHAFT headframe came from Idaho Maryland Mines in California.



ROCK BOLTING 2,425-foot level station at the No. 1 shaft.



KNIFE EDGE contact between magnetite and rhyolite porphyry at No. 1.



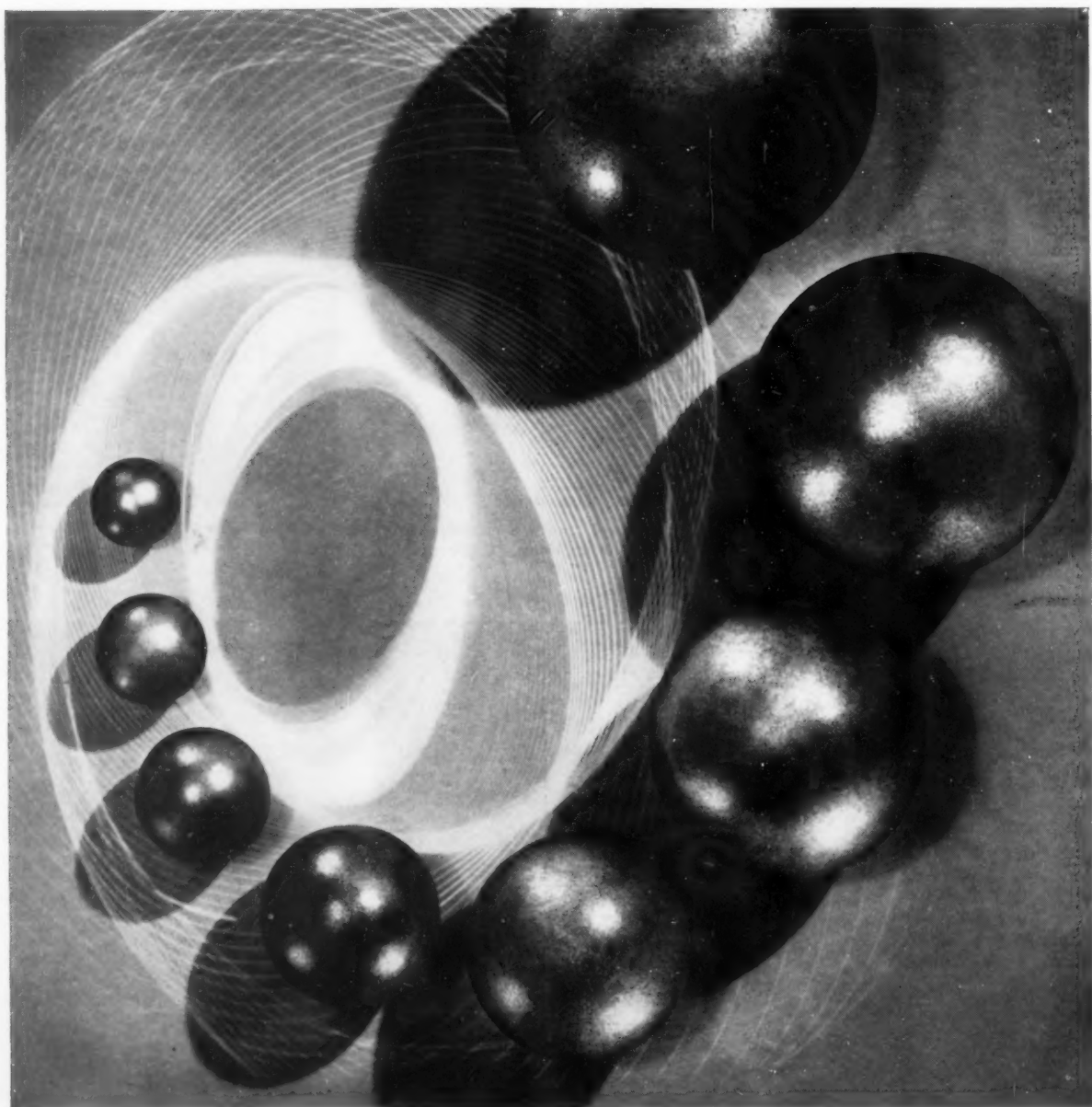
MINE superintendent, D. Bent shows magnetic attraction of ore to C. Bell.



DIAMOND DRILLER Willard Moore at the No. 1 shaft seeks ore boundary.



CATWALK permits general shaft foreman Charles Bell to reach bucket.



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5. Torque converter for smooth, efficient power increases line pull and productivity—prevents engine stalling
6. Long, wide crawlers for extra stability
7. Cab affords full-vision through safety plate windows
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Metal & Mineral Prices

U. S. A.

April 17, 1961

METALS

COPPER: Electrolytic, Delivered F.o.b. cars, Valley basis (pound)	29.00¢
Lake, Delivered, destinations, USA	29.00¢
Foreign, Delivered, destinations, USA	29.00¢
LEAD: Common Grade, New York (Per pound)	11.00¢
Tri-State Concentrate, 80% lead, per ton	\$125.16
ZINC: Prime Western: F.o.b. E. St. Louis (Per pound)	11.50¢
Prime Western: Delivered New York	12.00¢
Tri-State Concentrate, 60% zinc per ton	\$68.00
ALUMINUM: Primary 50 Pound Ingots (99.5% plus) (Per pound)	26.00¢
ANTIMONY: Lone Star Brand, F.o.b. Lorado, in bulk (Per pound)	32.50¢
BISMUTH: (In ton lots) price per pound	\$2.25
CADMIUM: Sticks and bars, 1 to 5 ton lots Price per pound	\$1.60
COBALT: 97-99%, keg of 500 pounds (Price per pound)	\$1.50
COLUMBIUM: Ingot	Nominal, per pound \$36.00-\$55.00
GERMANIUM: dioxide, high purity, gram	16.75-21.75¢
LITHIUM: 98% (per pound)	\$9.00-\$12.00
MAGNESIUM: Ingots (99.8%) F.o.b. Velasco, Texas per pound	36.00¢
MERCURY: Flasks, Small lots, New York	\$206.00-\$208.00
NICKEL: "F" Ingots (5 pounds) F.o.b. Port Colbourne, Ontario	75.50¢
PLUTONIUM: To July 1, 1962 AEC will pay \$30.00 to \$40.00 per gram depending on plutonium 240 content. July 1, 1962 to June 30, 1963, per gram	\$30.00
SELENIUM: 99.5% per pound	\$6.50-\$7.00
TELLURIUM: Common grade, Per pound	\$4.00
THORIUM: per kilogram	\$43.00
TIN: Grade A Brands, New York (Per pound) Prompt delivery	109.50¢
TITANIUM: 99.3% + Grade A-1 Sponge (Per pound)	\$1.50-\$1.60
URANIUM: Rod (0.790 U-235) \$16.00 Per Pound; Foil	\$16.75
U-235: Nominal (Per pound)	\$7.75
VANADIUM: 90% Grade	\$3.45
GOLD: United States Treasury Price	\$35.00 per ounce
London	\$35.16 per ounce
SILVER: Newly mined domestic, U.S. Treasury price per ounce	90.5¢
Foreign Handy Harmon	91.7¢
PLATINUM: Per ounce	\$82.00-\$85.00
ZIRCONIUM: Sponge, Per pound, Reactor Grade	\$5.00

ORES AND CONCENTRATES

BERYLLIUM ORE: 10 to 12% BeO, F.o.b. mine, Colorado	\$46.00 per unit
Small lot purchases at Custer, S. D., Spruce Pine, N. C., and Franklin, N. H. Visual inspection at \$400.00 per short ton or by assaying at 8.0 to 8.9% BeO, \$40 per unit; 9.0 to 9.9%, \$45; over 10.0%, \$48.00.	
CHROME ORE: F.o.b. railroad cars eastern seaports. Dry long tons.	
African (Rhodesian), 48% Cr ₂ O ₃ , 3 to 1 ratio	\$35.00-\$36.00
African (Transvaal), 48% Cr ₂ O ₃ , No ratio	\$26.00-\$28.00
Turkish, 48% Cr ₂ O ₃ , 3 to 1 chrome-iron ratio	Nominal \$36.00-\$37.00
U.S. Government are-purchase depot Grants Pass Oregon. Buying suspended, quota filled.	
COLUMBIUM-TANTALUM ORE: Per Pound Pentoxide, Nominal	\$1.10
IRON ORE: Lake Superior. Per gross ton Lower Lake Ports	
Mesabi, Non Bessemer, 51.5% Fe	\$11.45
Mesabi, Bessemer, 51.5% Fe	\$11.60
Old Range Non Bessemer	\$11.70
Old Range Bessemer	\$11.85
Lump: Plus 1/2-inch	\$12.85
Fines: Minus 1/2-inch	\$10.72
Swedish, Atlantic Ports, 60 to 68% Fe Contracts, Per Unit	24.00-25.00¢
Brazilian, Atlantic Port, 68 to 90%, Long ton unit	22.00-22.50¢
Venezuelan, Oranoco No. 1, 58% Fe, F.o.b. Porto Ordaz	\$8.95
MANGANESE ORE: Metallurgical grade, 48 to 50% Mn Long ton unit	\$0.95-\$1.00
Metallurgical grade, 46 to 48% Mn, Long ton unit	\$0.90-\$0.95
Metallurgical grade, 44 to 45% Mn, Long ton unit	\$0.85-\$0.90
Domestic U.S. Government, GSA Basis \$2.30 per unit for 48% Mn.	
MOLYBDENITE CONCENTRATE: 90% MoS ₂ , F.o.b. Climax, Colorado, Per pound Mo, plus container cost	\$1.25
TUNGSTEN CONCENTRATE: Domestic, 60% WO ₃ Per short ton unit	Nominal \$23.50
Foreign: 65% WO ₃ Per short ton unit (Scheelite)	Nominal \$18.00
Foreign: South American, Spanish, Portuguese	Nominal \$17.50
URANIUM ORE: F.o.b. purchase depot or company mill in accordance with AEC schedules and company buying contracts. Basic price is \$1.50 per pound of U ₃ O ₈ in ore assaying 0.10 percent. For each additional 0.01 add 20¢. Subject to development allowance, premiums, penalties where applicable.	

NON-METALLIC MINERALS

BARITE: Oil well drilling. Minimum 4.25 specific gravity, per short ton	\$16.00
BENTONITE: Minus-200mesh, F.o.b. Wyoming, Per ton, carload lots	\$12.50
Oil Well grade, Packed in 100 pound paper bags	\$14.00
BORON: technical grade — F.o.b. Boron California, Per ton	\$47.50
FLUORSPAR: Metallurgical grade, 72.5% effective CaF ₂ content per short ton F.o.b. Illinois-Kentucky mines	\$37.00-\$41.00
Mexican, 70% F.o.b. border, Duty paid	\$26.00-\$27.00
Acid Grade, 97% CaF ₂ Bulk, F.o.b. mine	\$45.00-\$49.00
PERLITE: Crude: F.o.b. mine per short ton	\$3.00 to \$5.00
Plaster grades, Crushed and sized, F.o.b. plants	\$7.00 to \$9.00
SULPHUR: Long ton, F.o.b. Hoskins Mound, Texas	\$22.50-\$23.50

London

April 17, 1961

	Per Long Ton	USA Equivalent cents per pound
COPPER: Electrolytic, spot	£230	15s 0d 28.54¢
LEAD: Refined 99%	£ 67	2s 6d 8.39¢
ZINC: Virgin, 98%	£ 84	10s 0d 10.56¢
ALUMINUM: Ingot, 99.5%	£186	0s 0d 23.25¢
ANTIMONY: Regulus, 99.6%	£210	0s 0d 26.25¢
TIN: Standard, 99.75%	£844	0s 0d 105.50¢
TUNGSTEN: Long ton unit	£ 0	121s 0d 16.94¢

*With Sterling Pound at \$ 2.80

Quotations on metals and certain ores through the courtesy of American Metal Market, New York, N. Y.

WHAT'S GOING ON in mining

Empire Mining Company Schedules Pellet Production in 1963



The Empire mine location, indicated by the small black rectangle on the accompanying map, is scheduled to be the site of a new Michigan open-pit mine in 1963. The Empire Mining Company has been formed by Cleveland-Cliffs Iron Company and two steel company partners to develop the mine. Cliffs holds 49.5 percent of the Empire stock and will manage the operation which will produce high grade pellets for shipment to the steel company partners.

The Empire will be the third Cliffs-operated and managed open-pit mine and pelletizing plant on Michigan's Marquette Range. The other two are the Humboldt and Republic mines whose locations are also shown on the map, as is Cliffs' major underground Mather mines. To better locate the Empire, the Champion underground mine of North

Range Mining Company and the Greenwood underground mine of Inland Steel Company are also shown.

Cliffs has been interested in the Empire for a number of years and conducted deep exploration drilling there seeking high grade underground ore about 10 years ago. Large reserves of shallow low grade ore were disclosed by this and more recent drilling.

Empire ore, assaying about 30 percent iron, is unique for the Marquette Range as it is the only known large deposit of magnetite. This will make magnetic separation feasible instead of the more expensive flotation used at both Humboldt and Republic. Fine grinding to at least 70 percent minus-325-mesh will be necessary, but this will be no disadvantage, as it is necessary to produce a good pellet.

Kennecott Continues Base Metal Discoveries In Tintic District

Underground exploration by Kennecott Copper Corporation in the Tintic district of Utah has developed a 1,500,000 ton high grade-lead-silver zinc ore body. Recent surface rotary drilling has located further promising mineralization in another section of the property. The company also has added to its holdings four patented mining claims adjacent to the Tintic unit. These were purchased from Silver Shield Mining Company.

The major discoveries by underground development were made on property owned by Chief Consolidated Mining

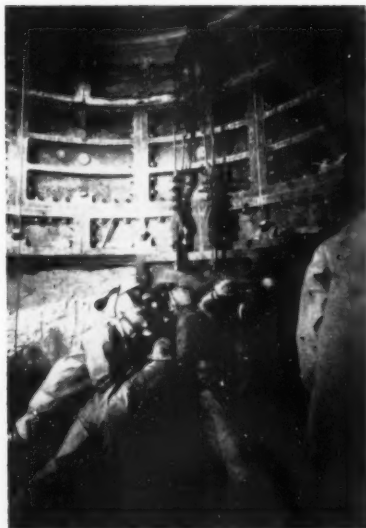
Company or its affiliates and the ore body intercepted in a drift from the furthest west crosscut was apparently the famous Eureka Standard fault, an important gold producer in past years. A 25° incline winze in the footwall of the ore body is down about 250 feet and will go another 150 feet to the right elevation for drifting. The winze is being driven to determine continuity of the ore body and ground conditions.

Bear Creek Mining Company, Kennecott's domestic exploration subsidiary, picked up 30 feet of silver-lead minerali-

zation while it was core drilling at about 1,270 feet on property northwest of the Burgin shaft and northeast of the old Tintic Standard No. 2 shaft.

Bear Creek had drilled by rotary tools to about 1,250 feet in order to determine thickness of volcanics overlying the host rock. When core drilling was started one 30-foot core, recovered between about 1,280 and 2,110 feet consisted of stringers of silver-lead ore. Some of the stringers were about one and a half inches in diameter. Coring is being continued to below the 2,110 foot-level in the quartzite.

International Tubs Shaft Through Water-Bearing Formation

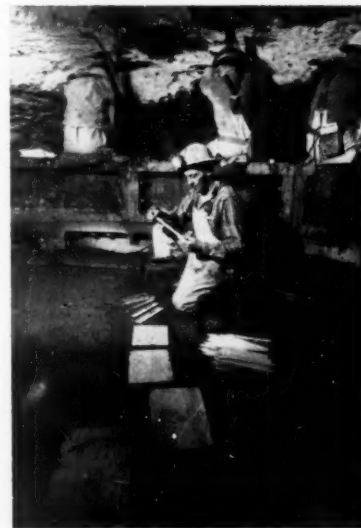


Miners install and bolt four-ton segments of cast-iron lining in shaft of the mine.

Conquest of a problem that has balked Canadian potash development for years was completed recently when International Minerals & Chemical Corporation (Canada) Ltd. finished the 3,000-ton cast-iron lining which protects the shaft at its Esterhazy, Saskatchewan, mine. To sink the shaft through the water-bearing sand and clay layers of the Blairmore formation, IMC's Canadian subsidiary, used a freezing and "tubbing" technique familiar in Europe but never before employed in this hemisphere.

Associated Mining Construction Ltd., which is made up of four German shaft-sinking companies, was brought in to sink through the stratum and install the lining or tubbing. After freezing a 50-foot area around the shaft location, penetration of the Blairmore began last fall. At five-foot intervals a ring of tubbing was installed, with each of the 76 rings made up of 11 four-ton segments. These ran from the 1,130-foot level to 1,488 feet.

To avoid water seepage at either end of the lining, three 55-foot sealing circles were installed, using the "pikotage" technique to effect the final seal. This method employed about 15,000 wooden wedges driven to create a solid mass.



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New Homestake President Checks Geology

Geological maps are checked by Dr. John K. Gustafson, new president of Homestake Mining Company before a recent trip underground at the Lead, South Dakota gold mine. In the picture above, taken at the Yates shaft collar are, left to right, Ab Shoemaker, vice president and general manager of operations; James Harder, manager of Black Hills operations; William Campbell, assistant mine superintendent; Dr. Gustafson; Arch Slaughter, chief geologist; Clarence Kravig, mine superintendent, and Roy Worthington, a mine division foreman. Dr. Gustafson, who became president of Homestake in January, wrote the thesis for his doctorate degree at Harvard on certain aspects of the geology of the Homestake mine and during the summer of 1930 did extensive geologic studies, mapping, and investigation there in preparation for that work. First director of raw materials for the United States Atomic Energy Commission when the world-wide uranium procurement program was initiated, Dr. Gustafson has recently been vice president of Hanna Mining Company of Cleveland.

Standard Metals Develops Three American Tunnel Veins

... now raising to Sunnyside "I" Level workings

Standard Metals Corporation is driving a raise to connect its American Tunnel with the lowermost or I level of the Sunnyside mine near Silverton, Colorado. An Alimak raise climber will be used to speed raising. Once a connection is made with workings on the Sunnyside Washington vein a survey will be made so that a second raise can be driven to connect with the present main winze in the Sunnyside. This raise will then become the main man and service raise above the American while the raise now being driven will be used as an ore pass.

Standard Metals spent \$734,000 in extending the American Tunnel in 1960 to cut the Washington and Belle Creole veins 380 feet below I level. This connection was made near the first of this year and since that date Standard has been drifting on the Belle Creole, Washington footwall, and hanging wall veins on the American Tunnel level. This work has indicated possibility of 2,000,000 tons of

low grade ore. Widths in Belle Creole are from 8 to 20 feet, 12 to 20 in Washington footwall, and 20 to 30 in Washington hanging wall veins. Samples from the veins have assayed gold 0.01 to 0.03 ounces, silver about 3.0 ounces, lead 3.0 percent, copper 0.60 percent, and zinc 6.0 to 8.0 percent per ton. The 1,800,000 tons of complex sulphide ore mined from all veins over many years by the Sunnyside Mining Company reportedly averaged about 0.06 ounce gold, 2.6 ounce silver, 1.15 percent copper, 3.1 percent lead, and 3.32 percent zinc per ton. From work done on the American level it now looks like the mine is primarily a zinc mine.

Standard Metals has rehabilitated the old Shennandoah-Dives mill north of Silverton. American ore is now being stockpiled for treatment when the mill starts operating in June.

William R. McCormick of Moab, Utah, is Standard president.

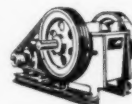
Colorado

Gunnison Mining Company, operator of a 200-ton-per-day uranium processing mill at Gunnison, Colorado, has been acquired by Kerr-McGee Oil Industries, Inc., through its subsidiary, Kermac Nuclear Fuels Corporation. A similar mill at Lakeview, Oregon, owned by Lakeview Mining Company, has also been acquired by Kerr-McGee, along with ownership of that firm, whose future operations will be conducted in the name of Lakeview Division of the Gunnison Mining Company. According to D. A. McGee, president of the Oklahoma firm, these acquisitions are part of his company's plan to

diversify and expand its mineral industry operations by acquiring strategically located chemical processing facilities. Both the uranium mills are solvent extraction plants which can be used for treating and concentrating raw materials other than uranium. Kerr-McGee has begun an intensive exploration in areas tributary to both Lakeview and Gunnison mills with a view to developing reserves of mineral raw materials that can be processed in these plants after their present Atomic Energy Commission contracts expire.

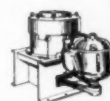
United Gold Mines of Colorado Springs, Colorado, will reopen to the old Theresa mine at Cripple Creek which

Laboratory Crushers and Pulverizers



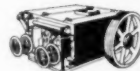
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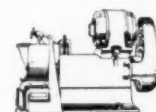
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WHAT'S GOING ON . . .

ROCKY MOUNTAIN

has been closed for 20 years. According to C. H. Carlson, mine manager, the levels will be opened up to leasers. It is the first separate new mining development opened in the Cripple Creek-Victor area in recent years. The only other currently operating mines are the Ajax, Deadwood and El Paso.

Utah

Initial capacity of the \$30,000,000 Moab, Utah project of **Texas Gulf Sulphur Company** will be 1,100,000 tons of muriate potash a year, and the product is expected to be on the market by the end of 1962. The mine shaft, sinking of which is to be started this spring, will have a larger capacity, so that production can be upped by 50 percent as needed by additions to the surface plant. Texas Gulf had not early in April, announced what firm will sink the 2,800-foot shaft which will be 22 feet in diameter, but bids were in and under study. Construction has begun on another major phase of the project, a 36-mile railroad spur to the Cane Creek plant site from Brendel near Crescent Junction on the main line of Denver & Rio Grande Western Railway. Grading work on the spur began last month. Longest industrial spur ever built by the railroad company, the line will include a 7,100-foot tunnel. Texas Gulf last December acquired rights to the 11,400-acre potash property, part of a Federal reserve, under an option granted to the firm in April 1960 by **Delhi-Taylor Oil Corporation**, which will participate in profits. (Harrison International of Florida, off-shoot of Patrick Harrison Company of Canada, was awarded contract to sink shaft.)

American Zinc Lead and Smelting Company is drilling for copper on the **Bawana** claims located in the Rocky district northwest of Milford in Beaver County, Utah. Two core holes are being drilled on the property which is leased from the **Majestic Oil and Mining Company**, which last year joined with **Bogdanich Development Company** of Salt Lake City and Los Angeles to investigate the property. Bogdanich leased the property from **Cerro Verde Mining Company**. In earlier drilling, 12 diamond drill holes indicated a fair tonnage with copper, gold, and silver values.

Production from the **La Sal** uranium mine of **Homestake Mining Company** in the Big Indian district of Utah was 45,326 tons of ore with a grade of 0.38 percent uranium oxide. The **North Alice** mine in the same district, which is held under lease, produced 94,150 tons averaging 0.20 percent uranium oxide. Development on these claims continues to encounter good ore, and the outlook is promising. Ore reserves in both properties are in excess of the total market available under existing contracts.

Suntide Corporation has acquired eight unpatented mining claims, including the **Tar Baby** tunnel driven in the 1920's, at the South Fork in Little Cottonwood Canyon near Brighton, Utah. H. G. Metos, Salt Lake City attorney and president of Suntide, said the claims were purchased from **Paramount Oil Company**. He said Suntide hoped to start work in the summer in driving drift from the

Tar Baby tunnel to intercept two fissure systems. Earlier operators of the **Tar Baby** property produced silver, lead and copper.

Wyoming

The 500-tons-per-day uranium mill to be built by **Petrotomics, Inc.** in Wyoming's Shirley Basin is scheduled to be in operation by March, 1962. Sixth uranium mill in the state, it will be built near Petrotomics's open-pit mine and will use a new process that will be tested at a pilot plant at Golden, Colorado. The company is already mining and stockpiling uranium ore to fulfill a contract with the Atomic Energy which runs from March, 1962 through 1966. Petro-

tomics was formed last year by **Kerr-McGee Oil Industries, Inc.**, and **Tide-water, Skelly and Getty** oil companies.

The man-shaft at the **Stauffer Chemical Company** trona mine near Green River, Wyoming, had been concreted-lined to 210 feet by early April, and construction at the plant site was progressing well. The shaft, one of two that will go to 1,000 feet, is scheduled to reach the trona ore beds in June. About 180 men are now employed on the \$22,000,000 project, about half the work force estimated when construction is in full swing. Final ballasting of the 10-mile railroad spur between the Union Pacific mainline and the bridge over the Green River has been completed, and rail placing on the bridge is being finished.



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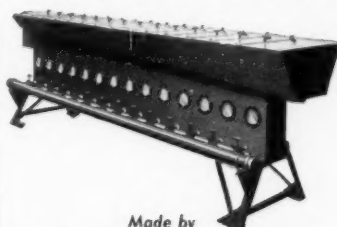


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Olin Mathieson Evolves Process To Make Aluminum From Clays

A breakthrough in the attempt to extract alumina from common clays and make the United States less dependent on foreign bauxite was described recently by Olin Mathieson Chemical Corporation, which plans to spend more than \$500,000 in verifying its new process. Details of its development were revealed at the dedication of the company's \$7,500,000 research center in New Haven, Connecticut.

Research on making aluminum from clay was conducted by Olin during World War II for the government but the process then developed was quite expensive. Olin resumed its studies about four years ago and has spent about \$300,000 perfecting it.

Since aluminum is ordinarily made from bauxite and the industry in this country imports more than 80 percent of its supply, the problem of using clay instead has been under investigation for over half a century.

Several processes have been evolved for extracting aluminum sulfate from clays and shales, and normally the resulting sulfate is in the form of tiny, soft, mushy crystals that are difficult to separate from the impure solution. The Olin process forms coarser, sand-like particles, from 1/8 to 1/16 inch in diameter, that are easy and inexpensive to handle.

The three-step Olin method first leaches low alumina content clays with sulfuric acid to put the aluminum and some of the iron in solution, next separates the iron and the aluminum sulfate so that the latter contains less than 0.03 percent iron relative to aluminum, and then processes the resulting crystals into alumina and re-cycles the sulfuric acid back for use again. Olin has evaluated several ways for thermal decomposition of the aluminum sulfate to alumina and will now test these methods in pilot plant equipment.

The Olin process will use material with as low as 20 percent alumina content, while most bauxitic ores now used contain 45 percent or more alumina.

Central

American Smelting and Refining Company reports that large-scale comprehensive geological studies in Missouri during the last year indicated favorable areas that justify more detailed investigation. Encouraging results were obtained by preliminary drilling for lead in one area where an intensive program is under way. ASARCO established a field office in Ironton, Missouri, about a year ago as a base for exploration activities, and has recently expanded the unit. The property being explored is west of Ironton.

Within a few weeks American Zinc, Lead and Smelting Company expects to have a report on shaft development, equipment, and estimated costs for its Bourbon, Missouri, iron project compiled by an engineering firm particularly experienced in developing and mining in the Pre-Cambrian. Granite City Steel Company, partner in the joint venture, is having a similar report made on the beneficiation flow sheet and the operating and equipment costs of beneficiating these ores and shipping a 65 percent iron pellet. The two firms expect to make a decision on the future program of the operation at a reasonably early date. During 1960 Amer-

ican Zinc operated three diamond drills and two churn drills in the Bourbon and Boss-Bixby areas, concentrating on the former during the last half-year. Boss-Bixby drilling has been reduced and confined primarily to churn drilling. However the company has applied to the government for a mining lease and when royalty rates are established diamond drilling activities will be resumed. (See MINING WORLD, March 1961, page 27 for map.)

A fire that caused \$2,500 in damages recently did not close down mining operations at **Minerva Oil Company's Mine No. 1** north of Cave-in-Rock, Illinois. The fire, apparently caused by a short in the re-charging panel in the miner's cap and lamp house, destroyed that building and about 45 lamps and equipment. It was quickly extinguished by the pressurized fire fighting system and equipment at the mine, and lamps were borrowed from other mines so that operations could continue.

Eastern

Production of vacuum cast billets will be doubled to 30,000 pounds of beryllium per month when construction at the Elmore, Ohio, refinery of **Brush Beryllium Company** is completed late this summer. The 70,000-square-foot new building and supporting facilities will also permit increased production of beryllium hydroxide, from which the metal, alloys and oxide are made. Last August the Pennrold Division of Brush moved to a new plant at Shoemakersville, Pennsylvania, which has a doubled capacity for processing beryllium copper strip. In its efforts to gain a measure of control over its future sources of raw material Brush has acquired a 29 percent interest in **Beryllium Resources, Inc.**, an exploration firm recently merged with another firm, **Dynamic Metals**, which is engaged in flotation research. Beryllium Resources holds mineral leases in the Topaz Mountain area of Utah, where test drilling has verified presence of commercial valuable deposits of beryllium. Other regions of North America and other countries are being explored and intensive development of ore beneficiation technology is being carried on.



Viburnum Mine Honored as "Underground Mine of Year"

Kenneth R. Baker, St. Joseph Lead Company's Viburnum Division superintendent, receives the MINING WORLD plaque in tribute "for developing the Underground Mine of 1960." The presentation was made at No. 27 shaft with the mine crew and supervisory staff in attendance. When Mr. Baker received the plaque from George O. Argall, Jr., Editor, he gave credit to the Viburnum organization when he said: "I believe that our most important asset in developing the Viburnum mine was the faithfulness and the cooperation of all members of the organization."

Roland F. Beers, Inc. of Troy, New York, has been granted an OME loan to explore for nickel in Knox County, Maine, where diamond drilling, electromagnetic survey work, and detailed field mapping has been under way since 1958. Total cost of the work under the exploration assistance contract is estimated at \$48,186. The Beers program, sponsored by a syndicate in which **Basic Incorporated** of Ohio and Nevada is the majority partner, has succeeded in finding what appears to be commercial deposits of nickel-copper ore in Maine. In 1959 Beers signed a long-term mining lease with the Maine Mining Bureau including about 150 acres of state-owned land. Earlier it had undertaken ground geological surveys and a diamond drilling program on the **Union** deposit 10 miles northwest of Rockland, which is in the south central section of Maine in Knox County.

During 1960 both tonnage and value of marketable phosphate rock production in Florida increased 7 percent over 1959, making that state the top producer of the country for the 67th consecutive year. Total mineral production reached an all-time high. Production of titanium ore, including both ilmenite and rutile, increased 9 percent in tonnage but the value remained the same as in 1959.

Shipments to the glass and ceramics industry from the new \$1,000,000 flotation plant of the **Feldspar Corporation** in Middletown, Connecticut are now being made. The company's proposal to lower freight rates between its plant and consumers has been approved by the Eastern railroads.

Although total mineral production in South Carolina decreased 4 percent during 1960, vermiculite output increased 5 percent and its value 12 percent for a new record. Feldspar production increased 64 percent in tonnage and 82 percent in value.

Cost value of three minerals in federal stockpile inventories at the end of January totalled \$1,179,000,000. Broken down these were: 7,400,300 tons of aluminum, bauxite etc., at a cost of \$498,000,000; tungsten, 84,000,000 pounds valued at \$341,000,000 and manganese (concentrates and ores), 4,900,000 tons at a cost of \$340,000,000.

Iron Ranges

Known reserves at the Vinegar Hill, Wisconsin properties of American Zinc, Lead and Smelting Company indicate the firm has five or more years of ore available at the present mining rate. Prospecting is being carried on by drilling on recently acquired leases which are within trucking distance of the company's milling operation. During the first half of 1960, operations at the Piquette mine were conducted on a satisfactory basis and during the last half, major development of the No. 1 ore body was undertaken. The development program was completed and the mine began producing in March.

New Jersey Zinc Company is proceeding well in pre-production development work at its Elmo mine near Platteville, Wisconsin. The program began last July and sinking of two truck haulage inclines is in progress. Engineering studies on the detailed design of the mill and the surface plant are well advanced.

The new concentrator at the Hill Annex mine, Calumet, Minnesota, being built by the Minnesota Ore Division of Jones & Laughlin Steel Corporation is expected to be ready for operation in the early part of the coming shipping season. Designed for a capacity of 500,000 tons of concentrate per year, it will treat Cretaceous iron-bearing minerals which are in huge stockpiles on the original surface of the property. These have been hauled and stockpiled in the past and held for future research studies and treatment. At the Hill Annex, the Cretaceous ores occur at the top of the iron formation and under the overburden. The materials contain fossils of marine life of ancient seas. Large and small shells of snails, bones and sharp teeth have been found wherever this material has been mined on the western end of the Mesabi Range.

Oglebay Norton Company has acquired an option on a low-grade magnetic ore body located between Eveleth and Virginia, Minnesota on the eastern Mesabi Range. At present, the company plans to drill and test the deposit for the feasibility of processing the taconite ore.

The Commissioner of Internal Revenue has issued a favorable ruling so that the two trusts to which Mesabi Iron Company plans to transfer all its assets will not be taxable as corporations. This means that royalty income received by the trusts from Reserve Mining Company and distributed to the beneficiaries will be taxable only to the beneficiaries and the trusts need not pay federal income tax on it. A proposed plan of liquidation for the company calls for Mesabi to transfer all its property to two trusts, one to be known as the Land Trust, which will own Mesabi's fee interests in the Minnesota lands, and the other the Mesabi Trust, which will own all the other assets. (See MINING WORLD, April 1960, page 46).

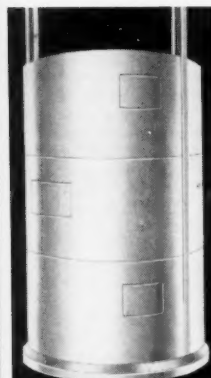
One of the oldest mines in the Marquette, Michigan, iron range—the Morris mine of Inland Steel Company at Ishpeming—will be closed by early summer. Rising production costs, problems caused by excess water in the mine, and the growing supply of higher-grade ores were factors in Inland Steel's decision to close the mine. Production during 1960 was 800,000 tons.

The tough ones come to Card

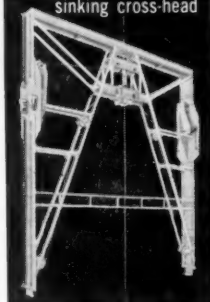


aggregate batch car

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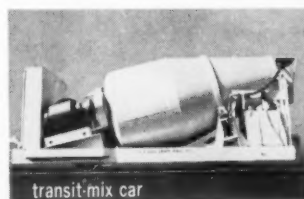


shaft pouring forms
sinking cross-head



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Columbia Iron Exercises Option on Alaska Claims

Columbia Iron Mining Company, division of United States Steel Corporation, will exercise the option held since 1956 on the Alaska magnetic iron ore property of Klukwan Iron Corporation. The agreement calls for Klukwan to receive for the first 10 years' minimum annual royalties of \$45,000, which will be increased to \$100,000 after that period.

If the property is brought into production, Columbia will give Klukwan a royalty of an undisclosed amount per ton of ore produced, based on a formula. The property consists of two groups of claims, one a magnetite lode group and the other a magnetite placer holding. During 1960 Columbia conducted a churn drilling program on the 102 placer claims and diamond drilling on the 108 lode claims. Extensive metallurgical tests have been conducted by Columbia which has operated a small pilot plant at the property, located 22 miles from Haines, Alaska on the Chilkat River.

Although no recent figures of reserves have been given, estimates by Klukwan some time ago put recoverable iron from the placer property alone at over 100,000,000 tons of 60 percent iron concentrate. Quebec Metallurgical Industries owns about 65 percent of Klukwan, and in turn is controlled by Ventures Ltd. of Canada.

Alaska

The Ketchikan, Alaska office of Mt. Andrew Mining Company at 428 Boden Street is under the direction of G. I.

MacInnis, geologist, who supervises the company's prospecting and development activities in the state, under general supervision of G. A. Noel, whose headquarters are in Vancouver, British Columbia. Mt. Andrew, a wholly owned subsidiary of **Utah Construction and Mining Company**, has been active in prospecting and developing mining properties in Alaska for several years and last year optioned a group of iron ore claims on Cleveland Peninsula at Vixen Inlet.

A shipment of 12 tons of concentrates from the Riverside mine of Hyder Mines, Inc., in the Hyder district of Alaska has been shipped to the **American Smelting & Refining Company** smelter at East Helena, Montana. The shipment assayed 74.2 percent lead, 40.2 ounces of silver per ton and 0.60 ounce of gold per ton, according to Carl Wikstrom, superintendent.

Idaho

The **Bunker Hill Company** has started using resin-treated lumber in corrosive areas at its electrolytic zinc plant and cadmium plant, and in shaft and station repair work. At the Benning-Strobel treating plant, Smelterville, Idaho, resin is forced into the lumber in a retort under 125 pounds of pressure, and when heat is applied the resin molecules expand and seal the wood. An automatic lubrication unit has been installed in the No. 1 hoist in the big Bunker Hill mine which is producing 2,300 tons of ore daily. Charles E. Schwab is company president.

The **Star** mine at Burke, Shoshone County, Idaho is being operated continu-

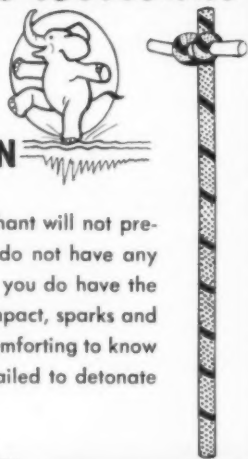
ously on a five-day week basis. Idaho's largest zinc mine, it yielded 245,326 tons of ore assaying 9.7 percent zinc, 4.2 percent lead, and 1.3 ounces of silver per ton in 1960. Ore reserves at year's end were estimated at 650,000 tons. The mine is owned by the **Bunker Hill Company** but operated by **Hecla Mining Company** on a fee basis.

Deepening of the **Conjecture** mine shaft, Lakeview Mining district, Bonner County, Idaho is averaging eight feet daily on a three-shift basis. At last report, the shaft had been deepened 100 feet below the 1,000-foot level. It is to be carried down to the 2,000 level. **Federal Resources Corporation**, Salt Lake City, Utah, is the operating company under a profit-sharing arrangement with **Conjecture Mines, Inc.**, Spokane. Federal has opened an engineer's office at Bayview, across Pend Oreille Lake from the mine, and R. W. Neyman, president of Federal, is keeping a close eye on work at the property. Donald E. Majer heads Conjecture.

Idaho's 1960 mine safety award for Class A mines has gone to the **Sunshine Mining Company** of Kellogg and the Class B plaque has gone to the **Clayton Silver Mines** of Clayton, Idaho. Announcement of the awards was made by George D. Fletcher, state mining inspector.

At the **Galena** mine in the silver belt west of Wallace, Shoshone County, Idaho, No. 3 ventilating shaft is being advanced on an around-the-clock basis and at last report had reached a depth of about 500 feet. An exploratory drift north of the Polaris fault on the 2,800-foot level had

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encountered promising mineralization. The mine is owned by Callahan Mining Company and operated by American Smelting & Refining Company under a profit-sharing lease. J. C. Kieffer, of Wallace, is manager of Asarco's northwestern mining department.

Operations at the Bear Top lead mine in the Murray sector of the Coeur d'Alene mining region, Idaho, are scheduled to be resumed this spring. Merger Mines Corporation leased upper workings of the Bear Top last year after clearing up titles, and some preliminary work was done. Mining, diamond drilling and driving of a short development tunnel are included in plans for 1961. E. C. Gerry of Coeur d'Alene, is secretary of Merger.

Joe A. Foster, president of Silver Star Mines, Inc., said that diamond drilling below the 450-foot level of the Rockwell shaft of the Silver Star M. Queens Mines at Bradford, Idaho, shows presence of the famous Minnie Moore vein south of the south fault. Bradford is two miles from Bellevue, Idaho. The Minnie Moore vein had a production of about \$9,000,000 when it was active.

General Mines Corporation has removed 30 feet of overburden at its property on Little Pine Creek, east of Kellogg, Idaho, in preparation for downhole diamond drilling near the adjoining Page mine. Two electric transformers and an electric motor were installed at the property in 1960 and 3,000 feet of airline reconstructed to the underground shaft and hoisting station. H. G. Loop of Spokane, Washington, is president.

Montana

Production of copper ore at the Berkeley pit of The Anaconda Company in Butte, Montana, during 1960 averaged 32,610 tons per operating day, compared with 28,500 tons per day in 1959, with the averaging stripping ratio 2.40 tons of waste for 1.0 ton of ore mined. Daily average for the Kelley block-caving operation was 11,505 tons; nine new ore blocks were brought into production and preparation of the 1,600 level for production included installation of track and other facilities. The veins in the Mountain Con mine produced high grade copper and recent development work on the lower level of the Steward mine which is being rehabilitated has disclosed high grade copper ore. Copper production from the company's Montana operations during 1960 was 181,994,776 pounds, compared with 140,392,026 in 1959. Total domestic mine output was 267,389,616 pounds, compared with 181,055,603 pounds the year before.

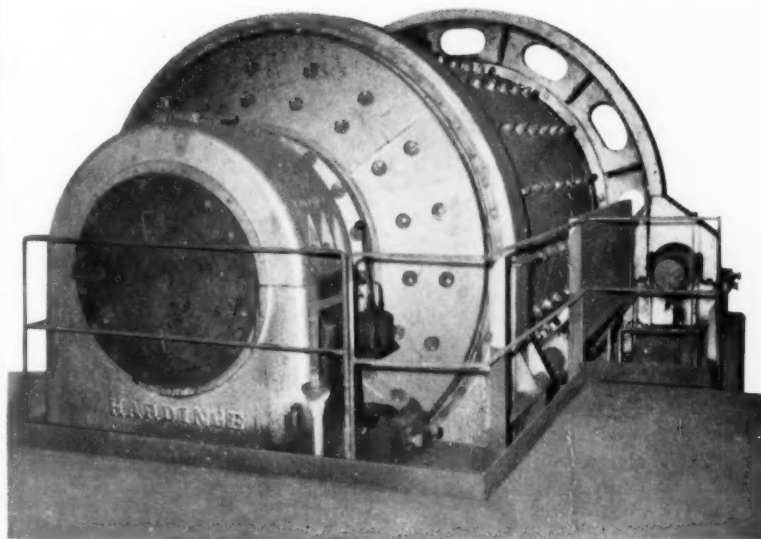
The Northern Milling Company of Townsend, Montana, has been licensed by the state of Montana as an investment company so that public offerings of the stock may be made.

An iron ore zone more than two miles in length and up to 1,000 feet wide exists in the Ruby Mountains in Madison and Beaverhead Counties, the Montana Bureau of Mines and Geology has reported. Initial exploration has blocked out 52,000,000 tons of ore, and reserves are estimated at more than 280,000,000 tons which could yield 100,000,000 tons of concentrate grading nearly 65 percent iron.

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Anaconda Will Reopen Leonard Mine Well Ahead of Schedule

Reopening date for the Leonard mine of the Anaconda Company in Butte, Montana, has been moved up about two years from the time originally scheduled under the company's deep-level development program. Preliminary work has been started on the shaft and haulage levels so that operations can be resumed late this year or early in 1962.

The Leonard, which has been closed since June, 1958, will be reopened on a gradual basis, with an eventual production goal of 1,000 tons a day planned. Ore from the mine will be trammed on the present 1,600 and 2,000-foot levels of the Kelley mine for hoisting in the Kelley shaft, while service will be through the East Colusa and Leonard shafts. Ore to be mined from the Leonard in the project now starting lies above the 2,000 level. When deeper zones are worked after completion of Anaconda's multi-million dollar, five-year deep-level program, production is scheduled to go up to 1,800 tons daily.

Reactivation of the Leonard and a planned increase in high grade ore output from the company's Steward mine in Butte will be offset somewhat by further curtailment in low grade mining to conform to the reduced copper production schedule now in effect.

Anaconda is also making studies to determine if zinc production can be made possible in Butte at current prices. At present there is no zinc or manganese mining in the area because of the imbalance between production costs and the market.

Washington

Estimated ore reserves of the Gold Dollar ore body at Republic, Washington, were nearly doubled during 1960 and are sufficient for more than five years' operation. The property is owned by Day Mines, Inc., and has been developed and mined for several years by Knob Hill Mines.

More than \$7,000,000 worth of concentrate was produced by Dawn Mining Company in 1960. The company, 51 percent-owned by Newmont Mining Corporation, New York, and 49 percent-owned by Midnite Mines, Inc., Wellpinit, Washington, operates the Midnite uranium mine in the Spokane Indian Reservation, Stevens County, Washington, and a uranium processing plant at Ford, Washington. Of the total 170,142 tons of ore milled, 7,227 tons were produced by other operators. Ore reserves, including stockpiled material, total more than 1,000,000 tons. This figure includes ore in two nearby leases purchased in 1960 from Silver Buckle Mining Company, Wallace, Idaho. Dawn's concentrate sales contract with the AEC has been extended from March 31, 1962, to December 31, 1966.

Exploration and development of two old Stevens County, Washington, lead mines is planned this season by a California firm, Superior Mining and Dredging Company. The firm, which has a gold dredging operation at Johnsville, California, leased the Electric Point mine with an option to buy, and purchased the nearby Bechtol property outright. Both are near Leadpoint in the Northport mining district. The Electric Point, on Glad-

stone mountain, was Washington's largest lead producer from 1916 to 1921 and was noted for its high-grade "chimneys" in limestone. Bulldozing and rotary down-hole drilling are planned to seek new ore chimneys. The Bechtol, which also had some early-day production, will be outfitted with a Diesel-electric air compressor and other mining equipment following construction of an access road. F. R. Walkley of Spokane will be in charge of operations for Superior Mining, of which Carl W. Weller, Coalinga, California, is manager.

A pilot mill at the scheelite property of Chief Jo Tungsten, Inc., on the Timm Brothers ranch, Okanogan County, Washington, has been enlarged to a capacity of 100 tons daily. Exploration and stripping of overburden from the near-surface deposits have been underway since their discovery in 1956. Fred Timm, Okanogan, is president of the Washington firm, and Roy Bedard is secretary.

More work is planned for this season at the Iroquois group of mining claims in northeastern Stevens County, Washington. Under an agreement with Mines Management, Inc. of Spokane, owner of the property, Rare Metals Corporation of America has been doing annual assessment work since 1959. The El Paso, Texas firm has been investigating possible extensions of a lead-zinc mineralized zone disclosed in underground work carried out by Mines Management. The Spokane firm, which is headed by Randy Green, a mining engineer, plans to do annual assessment work again this year at its Advance zinc-lead mine in Stevens County's Northport mining district.

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Arizona



University of Arizona Honors Eugene D. Gardner

For his notable contributions to mining in the Southwest, Eugene D. Gardner, left, of Washington, D. C., was honored by the University of Arizona which awarded him the Award of Merit as part of its 75th anniversary observance. The award was bestowed by Marling J. Ankeney, right, director of the U. S. Bureau of Mines, on behalf of J. D. Forrester, Dean of the University's College of Mines. Mr. Gardner, retired Chief Mining Engineer of the Bureau, is a mining engineering graduate of the University of Utah. His career in the Southwest included service with the Bureau of Mines Station on the University of Arizona campus at Tucson.

Duval Continues Drilling At Arizona Copper Deposit

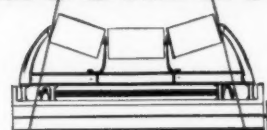
Duval Sulphur and Potash Company is continuing the drilling program at its Ithica Peak porphyry copper deposit located at Mineral Park, 14 miles from Kingman, Arizona. Evaluation work planned for this year is designed to further delineate areas of proven and potential mineralization and appraise the property's commercial possibilities.

By the end of 1960, 52 drill holes had been completed to develop a substantial area of copper-molybdenum mineralization. Mineral rights are held by the company under patented mining claims and locations, including leased claims. During the drilling program conducted by Boyles Bros. Drilling Company last year, much of the equipment was transported by helicopter from the loading level at 3,900 feet to the 4,900-foot high mountain top.

The deposit is a quartz monzonite stock mineralized with pyrite and chalcocite, with several shear zones that showed extensive copper mineralization cutting the stock.

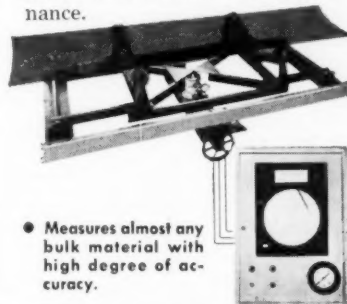
The area around Patagonia in Santa Cruz County, Arizona, is showing signs of increased mining and exploration activity by several firms and operators. Boyles Bros. Drilling Company has been diamond-drilling under contract to Utex Exploration Company in the Mineral Segregation of the Baca Float No. 3, while at Red Mountain, about four miles south of Patagonia, W. D. Roper of Safford is driving a 1,500-foot adit to investigate mineralized zones cropping out on the surface. Over 100 unpatented lode claims including the Buena Vista and Four Metals Group have been purchased by Jackson L. Mershon of Bristow, Oklahoma, from Coronado Mines Company. Nash and McFarland continue operation of the Trench mill, treating both custom ores and lead-zinc-copper ores from the Flux mine in the Harshaw district. The old Humboldt mine, located

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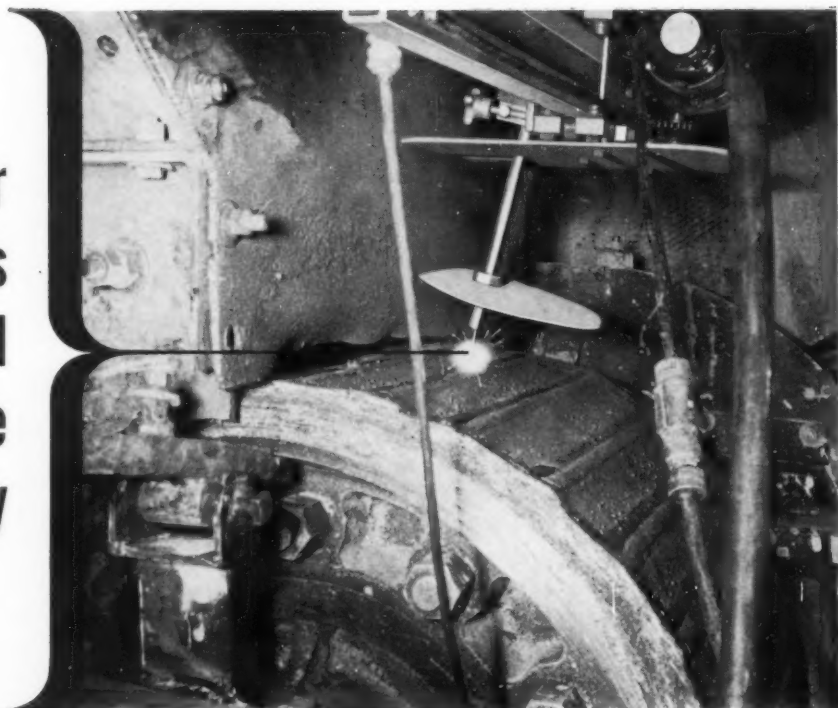
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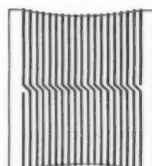
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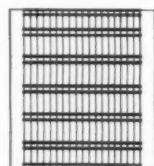
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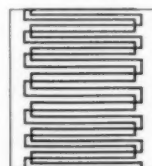
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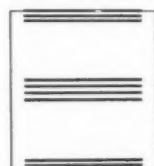
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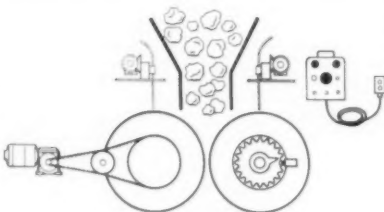


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WHAT'S GOING ON . . . SOUTHWEST

between the World's Fair and Trench mine, is reportedly being reopened by Art Robinson and his associates. A carload of copper-silver ore from the Montezuma mine near Salera was shipped recently by Larry Drake and his partners, and production continues. A detailed geological map of parts of the Patagonia Mountains is being prepared by Frank Simons of the United States Geological Survey.

With completion of its \$2,000,000 leaching plant at Bagdad, Arizona, in April, Bagdad Copper Corporation expects to recover copper from low-grade oxide ore which has been stockpiled in canyons near the mine for the last 15 years. According to George W. Colville, general manager, the plant employs the conventional leach-precipitation process to recover the copper contained in the stockpiles and from the oxide ore stripped to reach the ore supply for the flotation plant. These stockpiles, or strip dumps, are estimated to carry from 0.40 to 0.45 percent copper; and a smaller dump carries from 0.5 to 0.6 percent copper. The manufacturing section of the sulphuric acid plant was started up on February 8, with the first application of acid on the dumps scheduled for mid-April. Edward Howell, metallurgist, is leaching plant superintendent, assisted by Fred Wheadon, chemist. At full production the plant is expected to recover about 20 tons of copper a day.

A small gravity table is being installed at the Snaffle mine, near Cleator, Arizona, owned by the Tom Cleator estate. Opera-

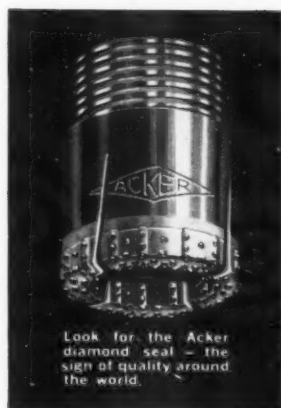
tors are Montague and Potts, partners, of Salt Lake City, Utah. They propose first to mine the narrow silver veins at the Silver Christmas claims, then to work the Snaffle when the market for lead-zinc improves.

California

American Potash & Chemical Corporation's output of primary products during 1960 totalled 784,062 tons compared with 769,486 tons in 1959. Products include borax, potash, salt cake, soda ash, and lithium carbonate. Shortly after a new evaporation plant to replace two of the present three systems is completed in June, the company will bring on stream increased facilities to produce boric acid and pyrobor at its Trona, California operation. A new potash granulation unit is also being installed to make larger quantities of granular muriate of potash. All these projects, calling for a total outlay of \$12,000,000, will implement the company's policy of making the Trona operation more flexible. Capacity to make boron products will be increased 35 percent, resulting mainly from a patented solvent extraction process which the company developed, whereby boric acid will be produced in a new and larger facility from boron values contained in weak brines. With this process the capacity for boric acid can readily be increased from time to time. The primary borax formerly used in making boric acid, together with the added boron production from the new evaporation plant will be used to increase output of dehydrated borax and other boron products.

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Nevada

Most recent reports available about the Eureka, Nevada, operation of **Ruby Hill Mining Company** state that 20 holes had been started by February 1, and 14 of these were completed. Four were stopped for various reasons and drilling continued on two more. While some additional ore was found, results so far have been disappointing. By that date also, over \$750,000 had been spent on the drilling program of Ruby Hill, which was formed to manage the exploration and possible development program at Eureka. Companies behind the venture are **Richmond-Eureka Mining Company**, **Cyprus Mines Company**, **Newmont Mining Company**, **Hecla Mining Company**, and **Eureka Corporation Ltd.**, a Canadian firm.

Stripping operations at the **Liberty Pit** operation of **Kennecott Copper Corporation** at Ruth, Nevada, are being speeded by use of a 300-ton electric shovel with a nine-yard dipper which scoops up more than 18 tons of rock each time the boom swings. The new shovel, assembled by mines maintenance shovel repairmen under direction of Frank Pozar, factory representative, cost some \$370,000. For each eight-hour shift it loads over 14,000 tons. The two 1 3/4-inch cables on the dipper are powered by a 500-horsepower motor and the bar pull is 200,000 foot/pounds. Length of the boom is 39 feet and overall height of the shovel from the sheave wheel to the ground is 40 feet. Six new 60-ton haulage trucks are among other new equipment being added to speed operations and provide more flexibility in mining schedules at Ruth.

Richard L. Bailey has acquired title to patented claims Standard No. 4 and 5, Black Rock and Extension Fraction in Pershing County, Nevada, which he has been prospecting under a permit.

Potash Company to Modify Concentrator in New Mexico

In order to mine and concentrate some high-grade ore now by-passed because it contains a small amount of magnesium, **Potash Company of America** will undertake a \$3,500,000 modification of its concentrator at Carlsbad, New Mexico. A study of the Carlsbad ore reserves indicates such a program will extend the life of the operation from the previously indicated 10 years to at least 16 years. The modification is expected to prove economic also by improving recovery, lowering costs, and producing high-quality products.

The program will take about a year to complete, and the company expects to maintain full production except briefly when the new facility is cut in.

New Mexico

The crew of one of the "wettest" mines in the Ambrosia Lake, New Mexico, uranium area has achieved an outstanding safety record—five continuous months of work without a lost-time accident. The group is the Section 25 underground mine crew of **Homestake-Sapin Partners**, which worked approximately 85,000 continuous man-hours to achieve the record, significant because the wet mines of the area have been plagued by safety problems since they were first opened up about two years ago. Under the Homestake-Sapin safety incentive program, the crew of 86 men and supervisors were guests at a safety celebration dinner, first ever earned by a wet mine crew at the company's operations.

Sabre-Pinon Corporation has reduced its partnership indebtedness to the Chase Manhattan Bank from \$9,500,000 to \$3,000,000, and expects to retire the indebtedness completely July 15.



ASARCO Stockpiles Ore From Mission's 210-Foot Level

Pit depth is now at the 210-foot level and ore is being mined and stockpiled for concentration at the nearly completed mill of **American Smelting and Refining Company's** Mission project south of Tucson, Arizona. Eventually some 50,000,000 tons of overburden will be removed at the pit where 10 tons of powder in 20 holes are used for the daily blast to break loose the overburden. Some of this has been used to build up the 70-foot mound which supports 600,000-gallon water storage tanks to be used in the mill. Much of the grinding and flotation machine installations at the concentrator are complete, as is the 15,000-ton capacity fine ore bin. Conveyors will connect the primary crusher with the crushed ore stockpile, then to the secondary crusher building, and finally to the mill. The mill was designed and is being built by **Western Knapp Engineering Company** of San Francisco, California. (To check progress of project, see picture in **MINING WORLD**, September 1960, page 69)

MORE NEW EQUIPMENT . . . AND NEW LITERATURE

MECHANICAL CONVEYOR catalog released by Syntrol Company contains eight fully illustrated pages offering complete data, descriptions, and specifications on light, medium, and heavy tonnage mechanical conveyors. Circle No. 1.

DUMP TRAILER: Technical literature on the engineering features of the new Pay-Pac dump trailer built by Spencer-Safford Loadcraft, Inc. is now available. Circle No. 2.

CARBIDE MINING TOOLS is the subject of a new 20-page catalog now being distributed by the Carmet Division of Allegheny Ludlum Steel Corporation. Details on the 28 styles of carbide mining bits, special carbide grades, mining tool identification, and detailed drawings on each of the mining tools are given. Circle No. 5.

TWO-WAY RADIO guide for businessmen has been issued by General Electric. This 16-page non-technical guide is titled "Under the Influence of Radio," and informs potential mobile communications users of some of the more important FCC licensing requirements as well as operational methods, how a message is sent, how to adjust a mobile radio, and record-keeping. Circle No. 6.

MINING AIR TOOLS manufactured by Thor Power Tool Company are described in a new 48-page catalog that carries a complete lineup of Thor tools for miners, tunnel builders, and quarrymen. Circle No. 7.

DRILL STEEL treated with the exclusive Sandvik process is protected against corrosion, and provides from 30 to 50 percent longer life than untreated steel according to Atlas Copco. Circle No. 8.

WATER CLARIFICATION: The many types and applications of modern Reactor-Clarifier treatment units for water and wastes clarification are described in a new full color illustrated 24-page bulletin released by The Eimco Corporation. Circle No. 10.

CENTRIFUGAL PUMPS for handling chemicals that are corrosive or abrasive, hot or cold, clear liquids or slurries are described in the new 16-page Bulletin No. 725.8 just issued by Goulds Pumps, Inc. Circle No. 11.

CORE DRILL for drilling or coring concrete, tile, glass, rock, and reinforced masonry is the new Ambassador manufactured by Acker Drill Company, Inc. Bulletin 27 shows that it is one of the most useful tools that a mining or construction company can buy. Circle No. 12.

WORM GEAR speed reducers made by Cleveland Worm & Gear Division of Eaton Manufacturing are now being made in nine new sizes ranging from 3-inch to 12-inch center distances, and from fractional to 175 horsepower. Circle No. 24.

CRAWLER CRANES are the subject of three comprehensive technical portfolios covering features and capabilities of the recently announced P&H models 525, 535, and 550 crawler cranes made by Harnischfeger Corporation. Circle No. 42.

DEWATERING PUMPS made by Gorman-Rupp are described in a new eight-page, full color bulletin containing specifications, performance, applications, and other general information on the three-inch electric motor driven centrifugal Submersible Dewatering Pump. Circle No. 20.

MINING ENGINEERING, design, and construction are some of the services offered by Western Knapp Engineering. Details of the company's activities and capabilities are given in a colorful new six-page brochure K2-B1. Circle No. 21.

MAY 1961

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FREE BOOKLET: "How to Measure and Relate Pipe, Tubing and Hose Sizes" is the title of a new 16-page booklet recently issued by Aeroquip Corporation. The booklet supplies standard methods of measurements, discussing both the similarities and the differences involved in measuring various fittings and fluid-carrying lines in order to arrive at satisfactory fluid line installations. Circle No. 23.

SINGLE-ROLL CRUSHERS manufactured by The Pennsylvania Crusher Division of Bath Iron Works are described in a new 12-page bulletin just issued. This bulletin is the first formal information available on the new Atlas crushers introduced late last year. Circle No. 26.

EXPLORATION SERVICES of Fairchild Aerial Surveys, Inc. has prepared a discussion of geophysical exploration for industrial minerals to serve as background for geologists who want to recognize situations where successful use of geophysical techniques may exist. Circle No. 13.

ABRASIVE PRODUCTS used throughout the mining industry are detailed in a new catalog just released by The Carborundum Company. "Catalog of National Standard Abrasive Belts, Rolls, Sheets and Discs" is the title of the 50-page booklet. Circle No. 28.

MOTODRIVE catalog G-100 is a new 38-page publication covering the complete line of Reeves Vari-Speed Moto-drives, 1/4 through 40 horsepower. For a copy of this information packed catalog circle No. 30.

FILTER MEDIA: Engineered fabrics and custom designed dust bags for solving any problem in industrial dust collection is the subject of Bulletin 14 released by The National Filter Media Corporation. Circle No. 25.

PORTABLE CABLES for surface mining are detailed by The Anaconda Wire and Cable Company in a new technical paper that covers cable requirements, maintenance fundamentals, and the repair of damaged cable. Circle No. 16.

RAILROAD CROSSTIE protection against plate cutting and spike killing is offered by Osmoplastic, a new development of Osmose Wood Preserving Company of America. Osmoplastic penetrates through the creosote to make ties last longer by reinforcing the creosote, hardening the wood, combating spike pull, and sealing out moisture and grit. Circle No. 31.

AIR FILTER: Bulletin No. 228 by American Air Filter Company illustrates and explains the new high efficiency DRI-Pak dry-type unit air filter that is compact and has high dust holding capacity. Circle No. 32.

FREE WALL CHART for choosing recommended chain pitch sizes for power transmission chain is offered by The Whitney Chain Company. Suitable for easy wall mounting, the two-color chart lists design horsepower on the vertical axis, rpm speeds for the small sprocket on the horizontal axis. Circle No. 33.

TROLLEY CONVEYORS is the title of a new 58-page book just issued by Link-Belt Company which shows what a trolley conveyor can do to reduce manufacturing and handling costs, and how to select the right trolley conveyor for any requirement. Circle No. 34.

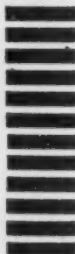
FEED-LEG DRILL that is 40 to 60 percent faster than preceding models is the new Ingersoll-Rand JR-300 Jack-drill that assures maximum production at lowest capital investment. Bulletin 4219 gives full information. Circle No. 35.

CRUSHERS by Sturtevant Mill Company assure long life at top loads for medium and small size plants. Many have operated for more than 25 years without major repairs. For bulletin 084 circle No. 36.

SLACKLINE CABLEWAYS are the subject of the new 18-page General Catalog C just published by Sauerman Brothers, Inc. Informative data and photos show how deep digging Slackline Cableways are used to recover sand and gravel deposits; clean river channels and settling ponds; excavate and haul bulk materials. Circle No. 27.



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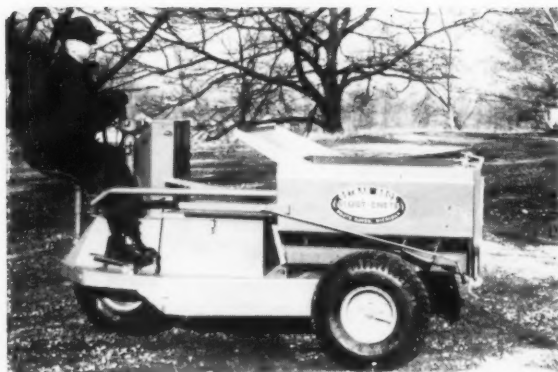


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PRODUCTION EQUIPMENT preview

FOR DATA ON ANY ITEM IN THIS SECTION PLEASE USE INQUIRY CARD



Small Electric Truck Carries One and a Half Tons

Introduction of a new battery-powered electric truck, known as Model BE-18, for underground mining, tunneling work, etc. has been introduced by Getman Brothers. The new unit has an overall length of 103 inches; width of 43 inches; height to top of dump body of 43 inches; a wheel base of 58 inches, and a dump box capacity of 2/3 yard. It has three speeds forward and three speeds reverse, and can carry a load of up to one and a half tons. Circle No. 91.



Versatile, All-Purpose Vehicle For Rugged Work

The new four-wheel drive Scout, built by International Harvester Company, is a low-cost vehicle designed for use where travel both on and off paved surfaces is involved. For exploration teams and around mines this all-purpose truck provides versatile, dependable transportation. The 100-inch wheelbase Scout, also available in conventional two-wheel drive, is powered by a 90-horsepower International four-cylinder engine. Circle No. 89.

Ceramic Magnet Separator

Stearns Magnetic Products have introduced the first permanent ceramic magnet wet drum separator designed especially for cobbing applications in the concentration of magnetite and reduced hematite ores. These new double-drum concurrent style units employ a remarkable new ceramic magnet material which provides field strength readings of up to 850 gauss at 2 3/4-inches from the magnet face—ratings equal to or in some cases higher than those of old-style electro-magnetic separators. Circle No. 85.

For Crushing Hot Sinter

A new type breaker for crushing sinter from the sintering machine has been developed by McLanahan & Stone Corporation. Using integral 9-inch hard-surfaced teeth to crush the sinter against special alloy grizzly bars, the breaker was developed for heavy-duty, continuous service.

The breaker currently is available in two widths, 72 inches and 94 inches, with a roll diameter of 24 inches. Water cooling is available for the crushing roll and roll shaft bearings. Circle No. 93.

Improved, Stronger Safety Hats

A new suspension assembly, stronger, 30 percent lighter, and more comfortable than other units, is now being incorporated in safety hats marketed by The Boyer-Campbell Company.

The new design requires only three components—the sweatband, the sizing band, and the supporting crown—contrasted to as many as 10 parts in other models, making it possible for large-volume safety-hat users to reduce replacement inventories substantially. Circle No. 53.

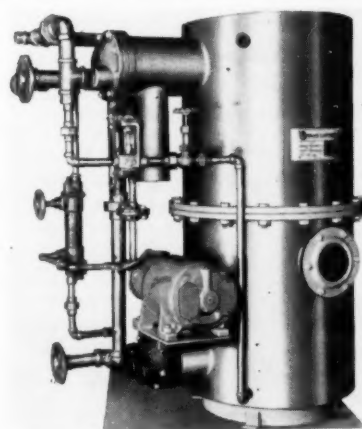
New Compact Evaporator Converts up to 500 Gallons a Day of Salt Water to Fresh Water

The introduction of a new line of low-cost, compact, heat recovery evaporators has been announced by the American Machine & Foundry Company. Sold under the trade name of "Aquavap," they bring moderate capacity fresh water production to a vast group of users. These new Maxim evaporators convert salt or brackish water to fresh water at no fuel cost, as their heat source is usually engine jacket water. As these evaporators operate under vacuum, the raw water is boiled at very low temperature, minimizing scale formation.

The evaporators are applicable to a wide variety of uses—in fact, anywhere where there is an internal combustion engine (or other hot water source). Thus, in isolated mines, offshore drilling rigs, construction camps, etc. fresh water

can be made from any available water by connecting the Aquavap to the jacket water of a working engine. The unit can produce as much as five gallons per day per unit of horsepower. Capacities of these units range from 500 to 12,500 gallons per day. The purity of the fresh water produced exceeds U. S. Department of Health standards, according to the manufacturer.

Another feature of the Aquavap is its extreme compactness. Units producing up to 500 gallons per day are less than four feet high, and laterally take a space of less than two by three feet. Aquavaps are virtually automatic in operation, and require no highly skilled technical personnel to attend them. They are delivered as standard, complete packaged units ready to install. Circle No. 74.





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INTERNATIONAL NEWS

UN Study Group Votes 65,000-Ton Lead Cut

World supply and demand for lead will be brought into better balance this year by voluntary curtailment of output by several of the major producing nations of the world. The cut, amounting to some 65,000 metric tons, will result from decisions made at the recent meeting of the International Lead and Zinc Study Group in Mexico City. Since zinc consumption for the most part has exceeded production during the last three years no curtailment action concerning that metal was taken by the group.

Reductions at mines are expected to be undertaken by Australia, Canada, Peru, and Yugoslavia, while cuts at smelters, totalling some 50,000 metric tons, will be carried out by Australia, the United States, Peru, Mexico, Sweden, and Yugoslavia. The USSR and Iron Curtain countries have expressed their intention to cooperate but did not say they would reduce their exports to countries in the Free World.

Total world production of lead in 1961 is expected to be slightly over 2,500,000 short tons, while consumption is expected to amount to some 2,570,000 tons, bringing supply and demand situation more in line.

The United States has also offered to barter lead from other countries for surplus agricultural commodities. This would remove 90,000 to 100,000 tons of surplus lead, accumulated before December 31,

1960, from the market. Negotiations are under way and must be completed by May 15, according to the agreement.

Representatives of 25 zinc and lead producing and consuming countries attended the Mexico City meeting, third session of its kind. Among the speakers was Dr. Schrade F. Radtke, research director of a broad-scope research program sponsored by American Zinc Institute and Lead Industries Association. He told the study group that the creation of new uses for zinc and lead, plus the expansion of existing markets for these metals can most effectively be achieved through international cooperative research. In citing accomplishments already made through the industry's research program, Dr. Radtke told of two improved zinc alloy compositions for hot chamber die casting processes, and of the development of improved electroplating techniques for automotive die casting.

Progress has been made too, he said, in the printing field where the traditionally popular zinc lithographic plates were losing ground to aluminum. An intensive research project has resulted in a new combination of plate coating and developer used with an improved zinc alloy that is of significant promise. Important achievements are also being made in the effort to aid the position of lead in competition with aluminum, steel, and plastics.

since it has an interest in several mines in Peru and Venezuela, and has carried out an aggressive exploration program for many years. The company was originally known as Consolidated Guayana Mines Ltd., after the Venezuelan gold property it operated up to 1951.

American Metal Climax Unit Joins Canada Tungsten Venture

Northwest Amax Ltd., a subsidiary of American Metal Climax, Inc. will join

two other Canadian firms in development of the tungsten deposit of Canada Tungsten Mining Corporation Ltd. in the Flat River area of Northwest Territories, Canada. Northwest will acquire a 35 percent interest in the tungsten firm and American Metal Climax will handle sales of the products throughout the world. Other participants in the venture are Dome Mines Ltd. and Ventures Ltd.

Final metallurgical studies and designs for a concentrator are already under way and equipment for the airport, construction of a road from the mill site to the ore body, and for starting the open-pit mining operation are being transported to the property which is in the McKenzie Mountain Range, 150 miles north of Watson Lake on the Alaska highway. The tungsten discovery was one of the major developments of the 1959 prospecting season.

Canada Tungsten has applied for permits to prospect a substantial area around its present 83 claims, and a large-scale exploration program is planned for this summer. Reserves are well over 1,000,000 tons, averaging 2.0 percent plus WO₃.

Southern Peru Mines 1.73% Copper During First Year

In 1960, its first year of operation, the Toquepala project of Southern Peru Copper Corporation produced 145,115 tons of blister copper. Start of operations was in January, five months ahead of the original planned date and the scheduled production was achieved in March. Mined production of ore and waste averaged 166,897 tons per day. Ore milled averaged 26,053 tons per day and contained 1.73 percent copper, which is substantially higher than the average grade of the ore body.

Southern Peru is owned by American Smelting & Refining Company (51½ percent) and by Cerro Corporation, Phelps-Dodge Corporation and Newmont Mining Corporation. The Toquepala is the first of three deposits to be developed in the area. Nearly 125,000,000 tons of overburden were stripped to expose the ore.

South African Firm Gives Diamonds for Project Mohole



Diamonds from South Africa for Project Mohole were inspected after their recent arrival in Washington by Wert T. Bayne, left, appraiser of merchandise for United States customs, and Willard Bascom, director of Mohole for the National Academy of Sciences.

The diamond drill stones, totalling about 3,000 carats, were a gift of Industrial Distributors (1946) Ltd. of Johannesburg, South Africa, to the project, which is a plan to drill a series of holes through the ocean floor, eventually sampling material beneath the Mohorovicic Discontinuity.

Some 2,500 diamonds are needed for each core-bit of the type to be used in the Mohole. To withstand the tremendous pressure expected, the stones must be large, solid crystals free of fragile edges or points that could break and pull out of the bit matrix. Actual drilling of the final Mohole depends on the outcome of present experimental drilling off the California coast.

Canadian Mining Firm to Drill Chilean Copper Property

Latin American Mines Ltd. has sent Canadian drillers and equipment to Chile to step up exploration work on the company's Grande de Tuina property. This copper property is located in the Atacama Desert of northern Chile, 40 miles east of the huge Chuquibambilla deposit.

Preliminary work by Dr. F. R. Joubin, consulting geologist for Latin American Mines, reportedly has already proven 1,000,000 tons, assaying 2.5 percent copper. This estimate is based on examination and sampling of some 20 old adits and shafts plus a recently completed 1,100-foot adit.

Two Japanese mining firms, Furukawa Mining Company and Nissho Company, have given Latin American Mines a letter of intent that they are prepared to purchase up to 18,000 metric tons of copper concentrate or cement copper annually from the Grande de Tuina property. However, the signing of this contract and financing is contingent on exploration proving at least 3,000,000 tons averaging 2.5 percent copper.

The Grande de Tuina mine was last operated in the late 1920's by British and Chilean owners who worked high-grade veins and hand-sorted the copper ore. Mineralization consists of malachite, azurite, chrysocolla, and atacamite as fine veinlets in sheeted zones in an altered gabbro. The property is well known by North American mining companies, having been examined by The Anaconda Company, Kennecott Copper Corporation, and Phelps Dodge Corporation.

Latin American Mines Ltd. is well known in South American mining circles

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- 1-54" x 48" Hirsch Ball Mill
- 1-5' x 10' Denver Ball Mill
- 1-64 1/2 Marcy Ball Mill
- 1-8' x 22" Hardinge Pebble Mill
- 2-32" x 36" Miners Finishing Mills

JAW CRUSHERS

- 6-21 1/2" x 31 1/4" New Morse Lab Crushers
- 4-4" x 6" New Morse Lab Crushers
- 2-5" x 6" New Morse Crushers
- 1-6 1/2" x 7" Hendy Jaw Crusher
- 1-10" x 20" Pacific Jaw Crusher
- 1-20" x 36" Diamond Jaw Crusher

CLASSIFIERS

- 1-30" x 14' Akins Simplex Spiral Classifier
- 1-36" x 20'6" Dorr Duplex Rake Classifier
- 1-8" Deco Hydro-Classifier

BATTERY LOCOMOTIVES

- 1-1 Ton General Electric
- 1-1 1/2 Ton Mancha Trammer
- 1-4 Ton General Electric
- 1-4 Ton Westinghouse Baldwin
- 2-5 Ton General Electric
- 2-6 Ton General Electric
- 1-7 Ton Atlas
- 3-8 Ton Ironton
- 1-8 Ton Goodman
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- 4-10 Ton Atlas

JIGS

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- 1-24" x 24" Bendelari Simplex
- 2-42" x 42" Pan American Duplex
- 1-42" x 42" Bendelari Duplex

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- 2-2" Wilfley Pumps
- 1-2" Wilfley Slurry Pump
- 1-2" Wemco Pump
- 1-2" Denver Pump
- 1-2" Gallagher Vac-Seal Pump
- 1-3" Wemco Pump
- 2-4" Allen-Sherman Hoff Pumps
- 2-4" Wilfley Pumps

LOADERS

- 3-Eimco 12 B Mucking Machines
- 1-Joy HL-20 Mucking Machine

FLOTATION MACHINES

- 1-1 Cell Denver 24" x 24"
- 1-1 Cell Morse Jetair 22" x 22"
- 1-1 Cell Fagergren, 27" dia.
- 1-1 Cell Fagergren, 36" x 36"
- 1-2 Cell Morse-Weinig, 37" x 37"
- 1-2 Cell Fagergren, 66" x 66"
- 1-4 Cell Denver 24" x 24"
- 1-4 Cell Denver, 38" x 44"
- 1-6 Cell Stearns-Roger, 31" x 31"

CONCENTRATING TABLES

- 6-Deister-Overstrom Diagonal Deck
- 6-Dunham "Economy" tables

VIBRATING SCREENS

- 1-18" x 56" Traylor Electric "Conveyanscreen"
- 1-42" x 72" Jeffrey Electric Screen, Type FB-2
- 2-4' x 6' Allis-Chalmers "Aero-Vibe" single deck screens
- 1-3' x 7' Robbins "Gyrex" single deck screen
- 1-4' x 8' Robbins "Gyrex" double deck screen
- 1-4' x 12' Diamond double deck screen

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- 1-Joy Model S-211
- 1-Gardner-Denver Model HEE
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- 1-Ingersoll-Rand Model HNN1J
- 1-Sullivan Model F-212
- 1-Sullivan Model F-211

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- 4-Ingersoll-Rand Model 10H
- 4-Ingersoll-Rand Model 14
- 1-Sullivan Model HA3
- 1-Sullivan Model L-111
- 13-Sullivan Model E-111
- 3-Joy Model F-113
- 4-Gardner-Denver Model HK

ELECTRIC TUGGERS & SLUSHERS

- 2-7 1/2 HP Sullivan Tuggers Model HE
- 3-7 1/2 HP Sullivan Slushers Model HDE-7-D212
- 1-15 HP Ingersoll-Rand Slusher Model A-11 NN-1G
- 1-10 HP Sullivan 3 drum slusher model A-312
- 1-60 HP Sullivan 3 drum slusher, model CF-312

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- 1-15 HP Coppus Blower, TM 8
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- 1-3' Corclone, VRC
- 1-EE10-4B Krebs Cyclone
- 4-66" Akins Duplex Spiral, 15 HP

COMPRESSORS

- 2-1528 cfm Joy Mod. WN114E, 300 HP, 2400 V
- 1-475 cfm Joy WG-9 12 x 9, 80 psi
- 1-2500 cfm Sullivan Class WN4, 2200 Volt

CONVEYORS

- 1-60" x 150' Conveyco, Lattice Frame 100 HP
- 1-42" x 1250' Link Belt, Steel Frame 2-100 HP
- 1-36" x 645' Link Belt, Steel Frame 2-100 HP
- 1-42" x 870' Link Belt, Steel Frame 100 HP
- 1-30" x 490' Jeffrey, 52H, Steel Frame 15 HP
- 1-30" x 450' Jeffrey, 52H, Steel Frame 15 HP
- 1-30" x 200' Jeffrey 52H, Steel Frame 15 HP
- 1-30" x 330' Jeffrey, 52H Steel Frame 15 HP

CRUSHERS

- 2-4' Symons Std. Cone, Fine bowl, 125 HP 440 V
- 1-15' Symons Std. Cone, Coarse bowl
- 1-15' x 24" Traylor Blake Type Jaw 40 HP 440 V
- 1-10" x 30" Pacific Jaw, 40 HP
- 1-7' Symons Std. Cone, 250 HP, 2300 V
- 1-5 1/2 Symons Shorthead, Cone, 200 HP

DRILLS

- 2-Ing. Rand Twin Engine Quarry Masters
- 2-GD 4 Jib Jumbo Drills, on D7 Cat
- 2-Joy 4 Jib MW-12 Wagon Jumbo Drills

FEEDERS

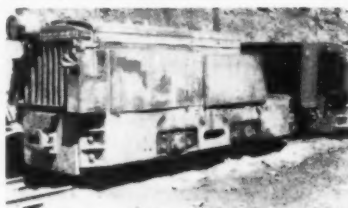
- 1-36" x 15' Link Belt, Steel pan 3 HP
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- 8-8" x 36" Jeffrey vibrating 2DH, 110 V
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- 1-24" x 72" Jeffrey Vib. 4H, 440 V
- 1-24" x 72" Jeffrey Vib. 4, 440 V
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JIGS

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- 1-16" x 24" Denver Duplex, Mineral
- 1-42" x 42" Yuba, M-8, 2 cell
- 12-42" x 42" Yuba, M-8, 4 cell

LOCOMOTIVES

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- 1-4 ton Mancha "Electric Mule" 24" ga
- 1-8 ton Plymouth Diesel, DHD, 24" ga
- 1-6 ton Mancha "Std AN," Battery, 24" ga

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- 1-7" x 22" Hardinge Conical, Lg. Trunnion, 75 HP
- 1-7" x 36" Hardinge Conical, Lg. Trunnion, 100 HP
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- 5-Eimco Model 105, Overhead

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- 2-2MRV-25 Ing. Rand 25 HP 440 V
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- 2-8" Dorrco Duplex, Type W, 5 HP
- 3-6" Dorrco Duplex, VM, 3 HP

VACUUM PUMPS

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- 1-17" x 10" Chicago Pneumatic NISB 25 HP

SCREENS

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- 1-9' dia x 54 1/2" Yuba, Trommel, 100 HP
- 3-4' x 12' Tyler Tyrack, 1 deck 10 HP
- 3-6' x 14' Hewitt Robins, MH-11, Scalping
- 2-6' x 12' Allis Chalmers, Lowhead
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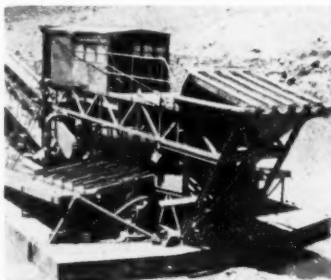
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Ore Testing Division**

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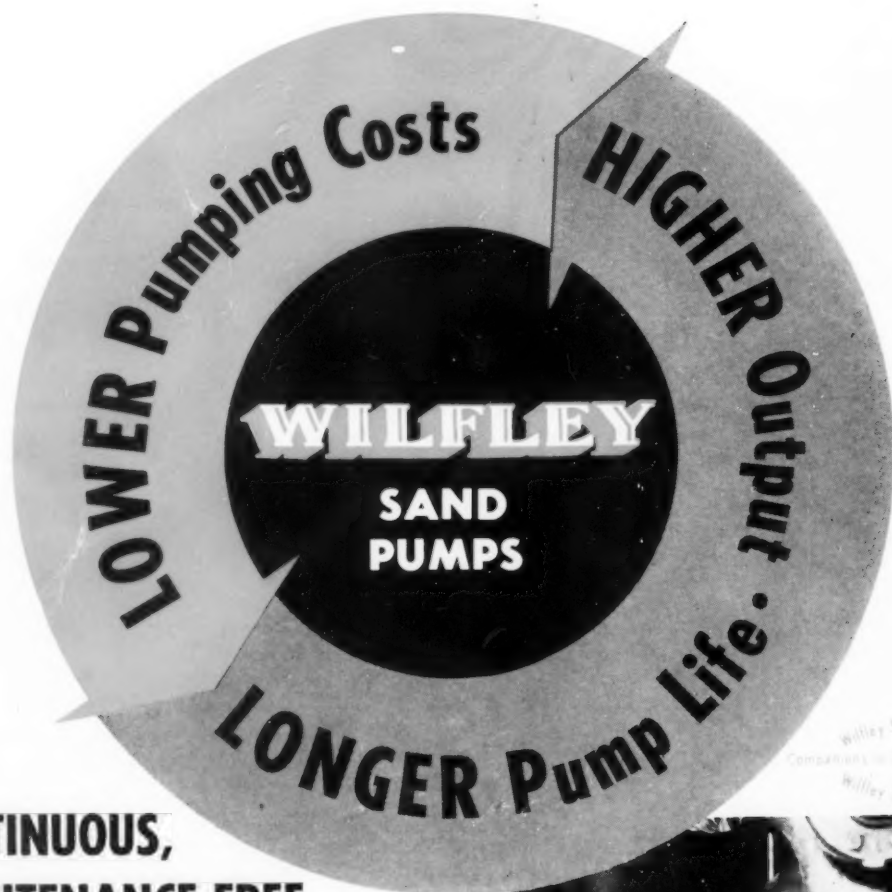


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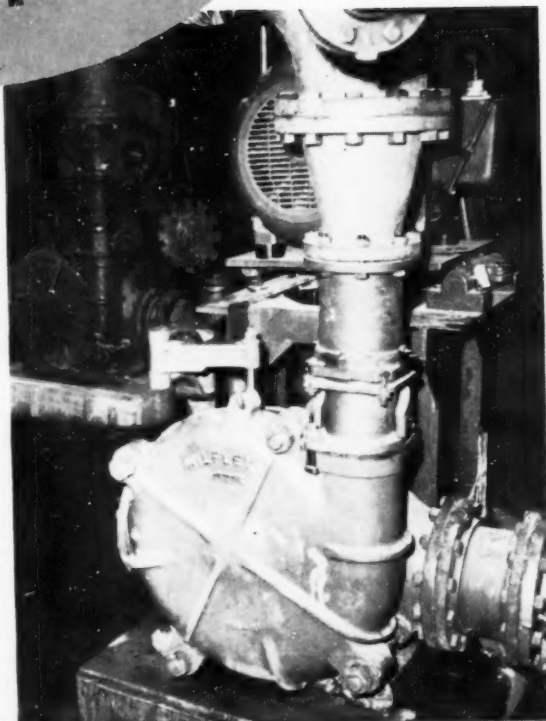


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